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NOTES FOR THE MONTH

Agricultural Conference

THE Ministry issued the following statement on March 18: The Agricultural Conference, consisting of representatives of farmers, workers and landowners, has now held nine meetings. At the first meeting on January 17 last, the representatives decided to concentrate on the proposals which would make it possible for a capable farmer on average land in this country to make ordinary farming pay. It was agreed that the key to this problem was the profitableness of cereal growing, as the decline of cereal growing had caused a reduction of the arable area and a change in the system of farming, which had resulted in increased competition in other branches of the industry, with a consequent reduction of the financial returns in those branches. Proceeding on this principle the Conference has considered various methods of improving the price which the British farmer receives for his wheat. One of these methods was the establishment of a National Wheat and Flour Board which, it was suggested, would be granted the sole power to purchase supplies of wheat and flour required by this country from abroad; the Board would also purchase home-grown wheat at a fixed price. Another proposal was that the millers in this country should be compelled to purchase a fixed quota of home-grown wheat, the price of which would be fixed by law at a level remunerative to the grower. Much consideration has been given to these two proposals, but the Conference has not been able to reach a unanimous conclusion on either of them up to the present.

At the meeting on February 28, the Conference passed unanimously the following resolution:—

> "This Conference views with the utmost concern the present position in arable agriculture, the increase in unemployment amongst agricultural workers, the amount of land going out of cultivation, and the lack of confidence created thereby. The Conference, therefore, desires to place before His Majesty's Government its unanimous opinion that measures should be taken to assure to farmers a remunerative price for cereals. The

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Conference has under consideration various proposals for securing this object, but further detailed examination of them is required to enable it to make final recommendations. Meanwhile, the economic condition of arable agriculture is deteriorating, and aggravating the unemployment problem. In order to avert further deterioration there is urgent need for an immediate pronouncement calculated to restore confidence to the industry in the meantime."

A resolution has also been carried by a majority recommending that the Government should announce a guaranteed price of 55s. per quarter for all home-grown wheat of the current year's growth, on the ground that only by a system of guaranteed remunerative prices for home-grown cereals could the position of the arable section of the industry be stabilized.

In addition to the subject of cereal growing, the Conference has discussed the problems of agricultural marketing organization, with particular reference to the disposal of surplus supplies of milk, potatoes and hops.

With the object of increasing the demand for home-produced meat and home-grown wheat, they also unanimously passed the following resolutions :—

(1) "That this Conference is unanimously of the opinion that, while it is considering larger and more fundamental issues, agriculturists throughout the country would welcome, as a sympathetic gesture, a decision by the Government to supply to His Majesty's Forces home-killed beef, at any rate for part of the year, and flour and bread made from home-grown wheat."

(2) "That this Conference urges the Minister of Agriculture to suggest to the Minister of Health the advisability of issuing a recommendation to all local authorities that all the meat and flour used in public institutions should be home-produced."

* * * * * *

The Development Commissioners' Nineteenth Report

THE nineteenth report of the Development Commissioners deals with the year ended March 31, 1929.* Emphasis is laid upon the important advance towards co-operation between the agricultural research workers of the Empire made by the formation of the Imperial Agricultural Bureaux, described in this JOURNAL for August, 1929. These Bureaux, as the Report rightly states,

*H.M. Stationery Office, or through any bookseller, 4s. net.

are to be welcomed, not only because of the assistance they will give to scientific workers in different countries, but as a development of the policy of co-operation by the Governments of the Empire for the promotion of agriculture by enlisting scientific aid.

The organization of the British national service for agricultural advice and research is already well known to most readers, and it is sufficient to say here that a brief account of the work at each Research Institute is given in the Report. Notes on the subjects engaging attention at Advisory Centres will also be found, while the lists of publications in the Appendices show the subjects on which sufficient progress has been made to permit of printed reports being issued. It must be added, however, that although an endeavour has been made to indicate the nature of the subjects in which the Institutes are engaged, it is almost inevitable that, in an Annual Report, short range and topical subjects should bulk more largely than those calling for prolonged study ; thus it is only by a perusal of the publications that the full extent and character of the work in progress can be gauged.

Particular notice is given to Schemes of Advice, etc., which have been formulated since the war. Among these may be noted the Economic Advisory Service, the Dairy Bacteriologists' Work, Veterinary Advice, the work undertaken through the medium of the Rural Industries Bureau and the Bedford Rural Electricity Demonstration Scheme. The Report is completed by a description of the progress of Fisheries Research work.

* * * * * *

International Horticultural Congress, 1930

THE Ninth International Horticultural Congress, which was briefly announced in the issue of this JOURNAL for June, 1929, will be held in London from August 7 to 13 this year, having its headquarters at the Royal Horticultural Society, Vincent Square, Westminster, S.W. 1, where full particulars of the Congress arrangements (which include an exhibition, receptions, visits, etc.) can be obtained. Delegates and members will assemble on August 7, the official opening being at 10.30 on the following morning. During the opening day and on Monday and Wednesday, August 11 and 13, a large number of papers will be read, appealing to various classes of horticulturists.

The scientific horticulturist and botanist will be interested in the papers of Group 1, of which Professor Priestley's contribu-

tion on "Vegetative Reproduction from the Standpoint of Plant Anatomy" will be important. "Sporting" in plants is a fascinating study, and Professor Baur (Germany), Professor Denny (U.S.A.) and Dr. Salaman should provide workers with the most recent knowledge on this subject.

For the fruit grower, Mr. Hatton's paper on growing fruit on known stocks, although it may not strike a new note, will be an important contribution on the stock problem. There will also be an opportunity of hearing what experts in other countries think of root stocks, for Mr. G. E. Yerkes (U.S.A.), Dr. Carl Dahl (Sweden) and Mr. Neils Esbjerg (Denmark) are to lecture on aspects of the same subject. It is expected that the foreign visitors will incline to support seedling stocks as opposed to the vegetative production now advocated at East Malling. Professor Barker will show how environments affect the behaviour of the trees and the stock question; while the way in which root stocks also affect tropical and subtropical fruits will be the theme of papers by Professors T. and Y. Tanaka (Japan) and Professor H. J. Weber (California).

Among lectures of a more popular character will be one by Mr. W. T. Macoun (Canada) on "National Tastes in Apples." British people think that Cox's Orange Pippin is the apple *de luxe*; Americans prefer the Macintosh; and the French award the palm to the Calville Blanche. Other papers in this group will be those by Professor Fedtschenko (Russia) and Professor Regel (Lithuania) on Botanical Gardens, the eastern European countries being greatly interested in this type of garden. A paper by Mr. G. Jacobsen (Norway) on "Electric Heating of the Soil" opens up a new method of raising early crops (as well as a new outlet for the use of electricity) which increased production and distribution of the current on popular lines may make possible.

* * * * * *

The 1929 Sugar Crop in England and Wales

PRELIMINARY returns for the 1929-30 beet sugar manufacturing campaign show greatly improved results. The ground lost in the previous year, when the area under sugar beet fell from 222,566 acres in 1927 to 175,734 acres, was more than recovered; the area returned on June 4, 1929, was 229,918 acres, which is the greatest so far placed under this crop. The good returns per acre in 1928 no doubt contributed much to the extension of acreage in 1929, which may also have been influenced in certain districts by poor prices realized for the potato crop.

Weather conditions were generally favourable. Severe frosts in February and March assisted the preparation of good seed beds, and although a generally hot and dry summer retarded growth, timely rains in October led to an increase in the weight of roots, which otherwise would probably have been very light. The weather continued mild and rainy throughout the autumn and early winter with the result that the beets continued to increase in weight until the first weeks in January. This continued growth led to an average yield of about 8·7 tons per acre compared with 7·7 tons in 1928 and 6·5 tons in 1927. Although this yield is still below the average yield obtained in most Continental countries, it is a distinct improvement and is actually the highest so far recorded in this country. The total quantity of roots delivered to the factories was 1,998,000 tons compared with 1,359,000 in 1928 and 1,449,000 for 1927. The rate of sugar content, which was very high in September, was reduced by the increased growth of the roots in late autumn and early winter, but the final figure was high for this country, being about 17·6 per cent. as against 17·39 per cent. in 1928 and 16·12 per cent. in 1927, whilst the tare, influenced by favourable lifting conditions in the early part of the harvest, was lower than usual, being 13·4 lb. per cwt. as against 14·5 lb. and 20 lb. in 1928 and 1927, respectively. The total production of commercial sugar, about 5,800,000 cwt., is equivalent to about 2,800 lb. per acre, which is more than 126 lb. higher than the previous record of 2,674 lb. per acre in 1926.

The average price paid for beet under the terms of the beet contract was 52s. 9d. per ton, comparing with 52s. 0d. in 1928 and 55s. 6d. in 1927.

The quantity of dried pulp produced was 138,145 tons, of which 74,431 tons were molassed and 63,714 tons were plain. About 6 per cent. of the dried pulp has been exported. The quantity of wet pulp produced was 18,837 tons.

* * * * * *

Notes on Sugar Beet Growing

THE following note has been communicated by Mr. A. W. Oldershaw, Agricultural Organizer for East Suffolk:—

A large proportion of the land devoted to sugar beet in England is located in East Anglia. The Chairman of the Suffolk Branch of the National Farmers' Union (Mr. David Black) recently observed that sugar beet was practically the only profitable arable crop to grow. It is a matter of the greatest importance to adopt every possible means to secure a high yield. The sugar beet prize scheme,

arranged last year under the joint auspices of the Ministry of Agriculture and Fisheries, the Sugar Beet Factories, and the local Agricultural Education Authorities, showed that many growers secured heavy crops, greatly above the average. Sugar beet, like most other root crops, responds extremely well to high farming and skilful management. Very high farming may possibly lead to laid crops of corn, a danger that does not apply to roots, although it may be possible to over-manure sugar beet, especially with nitrogenous manures. The risk, however, is not nearly so serious as with corn crops.

The first essential for a good crop of sugar beet is fertile land; frequent applications of farmyard manure in the course of the rotation are a great help. Good crops of clover and other legumes leave an abundant root residue which is of the greatest importance in increasing the fertility of the land. Artificial manures are of more benefit than is generally realized in increasing the root residues left by all crops; they are of especial benefit when they increase the yield and extend the root system of leguminous plants, so increasing the percentage of nitrogen in the soil. In growing sugar beet, it is extremely important that the land should be clean. In a favourable autumn, such as that of 1928 or 1929, tillage operations immediately after harvest are of great benefit, as the land receives what in many cases almost amounts to a fallow. In a wet autumn, it is best to plough immediately the stubbles are cleared, to prevent the very rapid growth of weeds which occurs after harvest when the soil is moist.

In our trials, sub-soiling has usually proved decidedly beneficial to sugar beet, but where there is no "pan" and the soil has been habitually cultivated deeply, either with the plough or steam cultivator, it is hardly necessary. Where there is a hard pan 10 or 12 in. below the surface, sub-soiling may be very important.

Farmyard manure may be applied, preferably in autumn. Complete dressings of artificial manures should also be given. Phosphates are probably best applied in the form of super-phosphate or other water-soluble phosphate at the rate of from 3 to 4 cwt. per acre on light land, to about 5 or 6 cwt. per acre on heavy land. The phosphate should be worked into the land before the seed is drilled. Potash may be applied in various forms. As a rule, less potash is needed on heavy land than on light. For average land 5 cwt. per acre of kainit, applied in February or March, or 2½ to 3 cwt. of 30 per cent. potash salts applied in March, or 1½ cwt. muriate of potash applied at the same time as the superphosphate will be found

a suitable dressing. Potash manure salts have been found in some cases to be particularly well suited for sugar beet.

Nitrogenous manures may be applied in the form of sulphate of ammonia, nitrate of soda, nitrate of lime, nitro-chalk, or calcium cyanamide. Calcium cyanamide should certainly be applied not less than a fortnight before drilling and worked into the land. If applied too near the time of drilling, it will very likely injure the germinating seeds. Sulphate of ammonia, nitrate of lime, nitrate of soda and nitro-chalk may be applied at the time of drilling. The disadvantage of doing this is that very heavy rain may wash some of the nitrate out, while the growth of weeds is encouraged. Alternatively, these fertilizers may be applied in two dressings given after the plants are up, or after singling. Which of these methods is best depends partly on the season and partly on the cleanliness of the land. On heavy land it is usually desirable to apply the nitrogenous manures early to encourage early ripening. When it is desired to lift the crop early on heavy land, it will usually be best to apply all the nitrogenous manures before drilling or very soon after. Under average conditions the total quantity of nitrogenous manures used should be from 2 to 3 cwt. per acre.

It is useless hoping to grow good crops of sugar beet if the soil is definitely acid; great acidity will lead to a complete failure of crop. If the soil is acid it is essential that lime, chalk, or some other form of lime should be applied. To mention an extreme case: chalk applied at the rate of 5 tons per acre in January, 1929, saved the crop on sour, very light soil at Tunstall Experimental Station last season, *i.e.*, in the same year it was applied. Where no chalk was applied, there was a complete failure of crop. On the chalked area the crop was good for the type of land.

To obtain a heavy crop of sugar beet it is important to secure a suitable number of roots per acre. For average land, probably about 30,000 plants per acre is the ideal, but on very light land, more are desirable—up to 35,000—while on heavy land excellent yields may be secured with considerably fewer, say, 25,000. Apart from a regular plant, which may be secured by the same careful tillage which is necessary for a good plant of mangolds, it is desirable to consider carefully (*a*) the width apart of the rows and (*b*) the width between the plants in the rows.

Under British conditions, and on most land, probably from 18 to 20 in. may be regarded as the best width between the rows. On light land, and where the land is clean, narrow rows are an advantage; on heavy land, or where the land

is not so clean, they may be wider. Where big-footed horses must be used in horse-hoeing, the rows must not be too close together, or many plants will be destroyed.

The field should be horse-hoed as soon as this can be done without covering up the small plants. This time depends partly upon the surface tilth and the number of stones present. Small clods or stones are very apt, with ordinary hoes, to cover up the beet. A horse hoe thoroughly adjusted so that there is no "play" anywhere, and fitted with discs to protect the plants, is a great help in making it possible to horse-hoe early. Many old horse-hoes are not really efficient enough for sugar beet. Experiments have shown the importance of early chopping out and singling, and this is now generally recognized. If, however, the weather is very wet at the time of chopping out, as was the case in East Anglia in 1927, it may be better to postpone the work for a short time rather than attempt to do it under almost impossible conditions.

It is fairly certain that many crops of sugar beet are reduced by two or three tons an acre by careless chopping out and singling. It is desirable that the farmer should himself chop out a square rod, and then count the plants. He will thus be in a position to tell his men how close he wishes them to leave the plants in the rows, in order to obtain the requisite number of plants per acre. If he is aiming at 30,000 plants per acre, about 190 are required per square rod. There is a general tendency to chop and single beet too widely apart in the rows. Usually, if an average distance of 9 in. from plant to plant be aimed at, the actual average distance obtained will be 10 in. or even more. It will undoubtedly pay the grower to exercise very careful supervision over the work of chopping out and singling.

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Agricultural Scholarships

THE Ministry invites applications for the under-mentioned scholarships which are being offered for award this year under the scheme of scholarships for the sons and daughters of agricultural workmen and others :—

About 130 Junior scholarships, tenable for courses not exceeding a year, in agriculture, dairying, horticulture or poultry-keeping at farm institutes.

Ten Senior scholarships, tenable at Agricultural Colleges or Universities for a diploma or degree course in an agricultural subject, or for courses in veterinary science.

The scholarships, which are open to the sons and daughters of agricultural workmen and other rural workers who are in

a similar economic position, cover the whole cost of instruction and maintenance, and neither selected candidates nor their parents are required to contribute anything towards the expenses involved. The method of selecting candidates is by interview; no written examination is required.

The scheme has now taken a conspicuous place in the general system of agricultural education in this country and its progress is regarded as highly satisfactory. Since its inception in 1922, 963 scholarships have been awarded and many of the students who have been trained have improved their positions substantially, whilst a number have obtained important posts in the industry.

Applications must be sent to the County Authority for Agricultural Education for the county in which the applicant resides not later than April 30, 1930. A copy of the conditions attaching to the scholarships, including a leaflet outlining the careers open to scholars, and forms of application may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1, or locally from the offices of County Councils.

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Agricultural Research

THE Ministry is prepared to receive, not later than May 15 next, applications for grants in aid of scientific investigations bearing on agriculture to be carried on in connexion with a University, University College or other approved Institution or Society in England and Wales during the academic year commencing October 1, 1930. The conditions on which these grants are offered are set out in the prescribed form of application (A.53/T.G.), copies of which may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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Agricultural and Veterinary Research Scholarships

THE Ministry invites applications for research scholarships in agricultural and veterinary science. The scholarships are tenable for three years from October 1, 1930, and are of the value of £200 per annum; extra allowances may be made for travelling and subsistence for periods spent abroad. The number of scholarships to be awarded will not exceed seven, and will depend upon the qualifications of the candidates.

Applications must be received not later than June 15, 1930, on the prescribed form (900/T.G.) which together with

a copy of the conditions attaching to the scholarships may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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Scholarships for Students Intending to become Agricultural Organizers, etc.

THE Ministry invites applications for agricultural scholarships from students who propose to take up posts as agricultural organizers, teachers or lecturers in agriculture, etc. The scholarships are tenable for two years from October 1, 1930, the second year of which will normally be spent abroad. The value of the scholarships will vary according to the scholar's means, but will not exceed £200 per annum whilst the scholar is in this country; extra allowances may be made for travelling and subsistence for periods spent abroad. The number to be awarded will not exceed five and will depend upon the qualifications of the candidates. Applications can be received up to June 15, 1930, on the prescribed form (A.472/T.G.) which, together with a copy of the conditions attaching to the scholarships, may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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Stud Goat Scheme, 1930-31

THIS scheme, which has as its object the improvement of the milch stock kept by cottagers, smallholders and others of similar position, will be continued during a seventh season commencing next September. Under its provisions, persons in the above-mentioned categories are enabled to procure the services of first-class stud goats for breeding purposes at a maximum fee of 5s. per service. As in previous years, a grant will be made to the British Goat Society to cover the payment of premiums and certain administrative expenses. Stud goats cannot be accepted unless they have been entered, or are considered eligible for entry, in the Society's Herd Book, and unless they are proved stock-getters and over 12 months old on September 1, 1930. Owners desirous of having their stud goats registered under the scheme should make early application to the Honorary Secretary of the British Goat Society, at 10 Lloyd's Avenue, E.C. 3, who will be pleased to furnish the necessary entry forms and other particulars. Applicants need not be members of the Society. The latest date for receiving applications is May 20.

THE DURATION OF ANTENATAL LIFE

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ONE of the trends of organic evolution is towards viviparous birth. That is to say, it has often been found advantageous that the offspring should develop *within the mother,* so that what is born is already well advanced. One obvious advantage of this viviparity, as against the egg-laying or oviparity that obtains in the vast majority, is that the early development goes on in conditions of relative safety, within the body of the mother. Laid or liberated eggs are apt to be discovered by hungry eyes and eaten; and among land-animals they are often in danger of being dried up.

A correlated advantage of *prolonged* viviparity is that the young creature is very well equipped when it is launched on the voyage of life. In such a familiar case as sheep, the newly born lamb can stagger after the ewe in a surprisingly short time, and everyone has seen that the same is true of the foal which stumbles so quickly after its mother. This is plainly of "survival value" in those gregarious mammals that are often on the move. A third advantage of viviparity is seen in those types in which the unborn offspring is a physiological partner with its mother, living for a prolonged period in nutritive connexion with her. This is pre-eminently true of the Placental Mammals, in which there is a very intimate and intricate union, by means of the placenta, between the mother and the unborn young. Though no solids can pass through the placental sponge from the one to the other, there is a diffusion of fluids and gases between the two. The mother contributes to the blood of the offspring (*a*) fluid food-materials, (*b*) oxygen, and (*c*) some hormones or chemical messengers. The offspring returns to the mother (*A*) nitrogenous waste-products, (*B*) carbon dioxide, and, in some cases, (*C*) hormones which enable the mother to make the best of her food. As (*A*) and (*B*) are poisonous, the advantage is very obviously on the side of the offspring; yet in some cases (*C*) the offspring helps the mother with a contribution of hormones. The intimate interchange goes on during the whole period of gestation, and the association well deserves to be called a symbiosis or vital partnership. This is a truer view, we think, than is suggested by the old description of the unborn mammalian offspring as a "fœtal parasite."

Viviparity.—Granting viviparity these advantages, we find significance in the fact that it has been attained independently

at several different levels in the ascent of life, and has always been rewarded with success for a time at least. One of the most archaic of terrestrial animals, in some ways intermediate between Ringed Worms (Annelids) and the insect-centipede series (Tracheata Anteunata), is a widespread type called *Peripatus*, which, with other nearly-related genera, is included in the class Onychophora or Claw-bearers. This relic of an ancient fauna holds its own partly because of its shy elusive habits, hiding under bark, in rotting wood, and among moss; and partly because of its unique way of feeding, for it squirts jets of gluey slime on small insects that pass by; but also *because it is viviparous*. The young one is nurtured for a long time within the mother—for thirteen months in the Cape species—and it is born fully formed, a miniature of its parents, more or less able to fend for itself. This is the reward of viviparity.

Unfortunately for farming and gardening, great success, as regards material well-being and increase in numbers, has attended the pests known as Aphids, Green-flies, and Plant-lice; and it is not a coincidence that throughout the summer months these theoretically fascinating, but practically detestable, insects are *viviparous*. In the summer months there are no males, and the parthenogenetic females produce their offspring viviparously. What leaves the virgin mother is an almost perfect green-fly, able at once to suck the sugary juices of plants; and in the course of a week or so this viviparously-produced daughter-aphis is able to continue the prolific succession. Agriculturally speaking, we wish this viviparity did not exist, but there it is!

We must not linger in this side-alley of our main theme, but the point is that over and over again in the course of organic evolution a trend towards viviparity has found expression. It must suffice to notice that the outcome of this recurrent trend is illustrated in various orders of insects; in a few fishes, amphibians, and reptiles; and that it becomes the rule in Mammals.

More than Viviparity.—In two of the viviparous sharks and in several viviparous lizards there are interesting anticipations of the *placenta*, which is so distinctively characteristic of ordinary Mammals. That is to say, at the low level of these two fishes, as Aristotle pointed out more than two thousand years ago, a nutritive connexion has been established between the unborn offspring and the wall of the mother's oviduct. It is also of interest to remember that the seeds of Flowering

Plants, as distinguished from the spores of Flowerless Plants, are well-equipped offspring which have developed for a considerable time in nutritive dependence on the parent plant, within which they are hidden away. The comparison must not be pressed, yet it is more than a coincidence that botanists should speak of the *placentation* of the ovules within the ovary.

Oviparous and Marsupial Mammals.—When some wide-awake natives of Australia first told the exploring zoologists that the Duckmole laid eggs, the report was received with natural incredulity. A mammal could not possibly lay eggs! But the natives were right and the textbooks were wrong: there are two types of *oviparous* mammals—the Duckmole (*Ornithorhynchus*) and the Spiny Anteater (*Echidna*). The duckmole lays two eggs in a nest in a burrow; the spiny anteater, after liberating its single egg, takes it in its mouth and places it in a temporarily developed skin pouch. The eggs of these "Monotremes," as the oviparous mammals are called, contain a considerable quantity of yolk, which is practically absent from the much smaller ova of other mammals. The ova of ordinary mammals are usually about the size of small pinheads, but those of the oviparous types or Monotremes, to which we have referred, are $\frac{1}{8}$ to $\frac{1}{6}$ of an inch in diameter when they pass from the ovary into the oviduct, and $\frac{3}{8}$ to $\frac{1}{2}$ inch when they are extruded. This relatively large size, which means that there is a considerable quantity of yolk, is obviously correlated with the fact that the further development of the Monotreme eggs takes place for the most part *outside* of the mother. When the young one is hatched, whether in the nest (Duckmole), or in the pouch (Echidna), it begins to lick the mother's skin on the area (on the under surface or in the pouch) bearing the numerous apertures of the milk glands, which are devoid of teats or mammæ. In these and in many other ways the Monotremes are obviously very old-fashioned. Perhaps we should notice that most zoological authorities distinguish a third genus, *Proechidna*, also oviparous and nearly allied to *Echidna*. This detail does not affect our argument.

Among Marsupials there seems to be only one type, the tree bandicoot or Perameles, which has the true (allantoic) placenta that is found in all ordinary mammals. The other marsupials do not get beyond a makeshift (yolk-sac) placenta, which also occurs as a transitory stage in the gestation of Rodents, Insectivores, and Bats. Thus the antenatal partnership between the Marsupial mother and her offspring is not so

intimate as that obtaining in ordinary mammals. Not only so; the gestation is very short—in some cases only a fortnight. In the large species of Kangaroo (*Macropus giganteus*), which may stand as high as a man, the period of gestation is only thirty-nine days; and then the young one is born, blind and naked, very imperfectly finished, and not much more than an inch in length! The prematurely-born young marsupials are peculiarly helpless, but they have the instinct to climb about on the underside of the mother and to enter the skin-pocket or marsupium if they succeed in reaching it. Indeed, they are so helpless that they cannot even suck the mammæ to which they become attached inside the pouch, which is developed in most, though not all, of the female Marsupials. The milk has to be forced down their gullet by the contraction of a special (cremaster) muscle around the mammary glands; and there is an interesting adaptation—the shunting forward of the top of the windpipe into the posterior nares—which enables the young one in the pouch to continue breathing while the milk is being forced down its throat. The temporarily continuous passage from the nostrils onwards allows the air to pass down the windpipe to the lungs, but prevents the milk going down the wrong way.

Another very interesting adaptation is that the teat or mamma swells inside the young marsupial's mouth, so that the very helpless creature is not likely to lose its hold. But the most important point is the general one, that the short gestation is correlated with a very half-finished state at the time of birth, a drawback which is met by the development of the marsupium or pouch. Thus the hint that we get from the remarkable state of affairs in marsupials is that a prolongation of the period of gestation is likely to be associated with the better equipment of the newly-born young one. It would be easy to find a female Kangaroo about the same size as a Shetland pony mare; but the former carries its young for 39 days before birth, and the latter for eleven months. Our proposition is that the extension of the duration of ante-natal life has been one of the conditions of the precocity of the newly-born foal—an idea that was first promulgated by Robert Chambers, the pre-Darwinian evolutionist, who wrote *The Vestiges of Creation* (1844).

Variety of Duration.—There is evidently some puzzle in the great variety in the length of the antenatal period in different mammalian types. "Why does the seal take eleven or twelve months for gestation when a large dog requires only nine weeks?" (F. H. A. Marshall, *Physiology of Reproduction*,

1910). Why does such a highly specialized mammal as a bat have a short gestation—in some species seven weeks—while in another climax of specialization, the elephant, it is twenty months, or even over two years? Why should a tigress carry her unborn young for twenty-two weeks, while the period for the nearly related lioness is sixteen?

Peculiar Cases.—In some mammals there are altogether peculiar features which must be kept by themselves, and not allowed to complicate the general problem. Thus in some of the European bats the pairing and insemination normally occur in autumn, whereas the ovulation and fertilization are delayed till the following spring. It seems that the spermatozoa remain stored in the genital duct of the female throughout the whole period of hibernation. In some other mammals where the fertilization immediately follows the insemination and the development begins at once, just as is usual, there is a strange arrest of development for a prolonged period. Thus, Marshall notes that while roe deer in Germany pair in autumn, the embryo does not develop beyond the segmentation stage till the following spring. There is often a long arrest in the development of the badger.

The General Theory.—Many variations in the length of the antenatal period in mammals have been recorded, especially towards an *increase* in the time; and thus it is quite legitimate to postulate variability in the length of gestation. This variability might be prompted by variations in the endocrinal or hormone-making system of the offspring, or in its capacity for making most of the food; but it is enough to say that as regards gestation, as elsewhere, variations in the rate or *tempo* of development are common. If these variations are continued in the inheritance from generation to generation, and if they are advantageous, then a change in the length of the antenatal life might become a new specific character.

Thus the question comes to be whether changes in the length of gestation may be of survival value. Are they so advantageous or disadvantageous that they might come to be sifted in the course of Natural Selection?

On the whole there is an advantage in economized reproductivity, since it lessens the strain on the mother: but a gradual reduction in the size of the family is hazardous unless there is some associated variation which increases the chances of the offspring's survival. This may be effected by an increased parental care, especially on the mother's side, as may be illustrated by bats which carry their young one through the

air. The very helpless offspring of monkeys and apes is often carried about, and the mortality seems to be low. Or the offspring may be hidden away, as wild cattle hide their calf in the thicket, and wild deer their fawn. Or it may be through a den that the safety of the family is secured, as in many Carnivores. But it is plain that another way in which the safety and success of the young offspring may be secured is by delaying its birth until it is more or less able to fend for itself. A lengthening out of the gestation allows the young creature to attain to a relatively advanced state before it is born; and Robert Chambers had the shrewd idea that a prolonged period of quiet development would favour the evolution of the brain. Thus there might result an improvement of intelligence and a reduction in the scope of instinct. The prolonged gestation of elephants (20 months), camels (13 months), horses (11 months), cattle (9 months) may be referred to in illustration. A prolonged quiet development of the brain, with abundant nutrition but without much excitement or activity, would favour cerebral advance.

While there are many cases where prolonged gestation is associated with an advanced development of the brain at birth, thus giving the young creature a good send-off, as far as wits are concerned, there is no doubt that the same result might be reached by having the litter in some safe retreat, as in many carnivores. In such types the gestation may be relatively short, *e.g.*, four or five months in the badger, which may be deceptively lengthened out in individual cases by the interpolation of a period of arrest. The gestation of the puma is said to be only fifteen weeks. It should also be borne in mind that while there is an obvious advantage in being born well-equipped in body and mind, as in the foal, a similar success may reward an animal born at a much less advanced stage, provided that it be safely hidden away and carefully educated by its parent or parents. The detailed education which the mother otter gives her cubs is well known, and there are many other instances.

Apart from the reward that comes to precocious intellectual development, another advantage of prolonged gestation and advanced equipment at birth may be recognized in cases where the habitat is very peculiar, with unique difficulties. Thus a young Cetacean must be able to swim and dive at birth, and it must also be able to suckle in the water. It is, therefore, not surprising to find that the gestation of porpoises and dolphins lasts for about ten months. Similarly, not much is known of

the intellectual gifts of the walrus, but there is no doubt as to the difficulties of its boreal haunts, and it is not surprising to find that its gestation lasts about a year, and the lactation or nursing period for about two years. This is an exceptional case that tests the rule or thesis, that prolonged gestation gives the young creature a good start.

There are no doubt other factors to be considered in interpreting the length of antenatal life as adaptively adjusted in the course of natural selection.

(*a*) Thus, when there is a regularly recurrent pairing time, there may have been a lengthening out, or perhaps a shortening down, of the gestation so as to ensure that the young ones are born at a suitable time of year. This seems to be brought about in certain cases, such as the badger, by a *modificational adjustment*, meaning by this phrase that changes in the rate of development are directly impressed on individuals by environmental, nutritive, and functional peculiarities. For instance, while it is said that conception may occur in the badger at any time of year, "the young are invariably born within a period limited to six weeks." This fact, cited from Marshall's admirable *Physiology of Reproduction*, to which we are as gratefully as obviously indebted, can only be explained, so far as we see, on the theory that unpropitious environmental conditions bring about an arrest of development, and this standstill has been actually demonstrated in the somewhat extraordinary case of the badger. Apart from such difficult cases, it seems reasonable to suppose that an adaptation of length of gestation to birth at appropriate seasons might be readily effected, if the length of gestation is a variable specific character, and if being born at an inappropriate time is rapidly fatal. If man can by reasonable interference secure that lambs and calves and foals are not born at very unfriendly times of year, there is no improbability in the theory that this sort of adjustment of time of birth and length of gestation to seasonal conditions may have been wrought out in the course of time by Nature's automatic sifting.

(*b*) Something must also be allowed for size. Thus Professor Sedgwick, a very shrewd zoologist, points out that "the duration of gestation depends on the size of the body and on the stage of development at which the young are born." This statement is perhaps a little tautologous in its second statement, since it is, in many cases, the length of gestation that seems to make the difference between being born rather helpless and being born with precocious powers. But as to the first

statement, there is no doubt that a large animal, such as an elephant or a whale, demands a long gestation. Even this conclusion must not be pushed too far, for wild swine have a gestation of about four months, about the same as in the much larger lion.

Thus we wish to rehabilitate the suggestion of Robert Chambers, that the lengthening out of the period of gestation is an adaptive change which has had as its survival value the advantage of the offspring being born with better brains and otherwise more fully equipped for the struggle for existence.

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THE ROLE OF VITAMINS AND MINERALS IN STOCK FEEDING

I—VITAMINS

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THERE has grown up during the last few years a very extensive literature on vitamins and minerals. This literature consists mainly of technical papers dealing with the results of research, articles in the popular Press, and propaganda by commercial firms who have put vitamin or mineral products on the market. This great mass of literature is confusing, and some of it is apt to be misleading to stock farmers anxious to apply reliable scientific information in practice. The technical papers are written by research workers for the information of other research workers. They deal with results obtained in laboratories, usually with small animals, and nearly always with special diets which would never be used under farming conditions. The results, therefore, do not apply directly to farming practice. Popular articles and propaganda writing, on the other hand, though on the whole fairly accurate with regard to the facts they do state, tend to magnify striking positive results of experiments to the neglect of negative results which, of course, are of little interest to the ordinary reader. They also overlook the fact that the results obtained in laboratories cannot be applied directly to the totally different conditions of practical farming.

Although in some popular and semi-popular writings the immediate practical importance of the results of recent research on vitamins and minerals has been exaggerated, there is no doubt that the information gained in the last 10 or 20 years is of practical value. Indeed, it is now being applied successfully both in human preventive medicine and in animal husbandry.

The present article gives a brief account of recently acquired knowledge and indicates its bearing on practical feeding problems. Unfortunately, although so much experimental work has been done, our knowledge of this "newer" aspect of nutrition is still limited, and our ideas are still growing and changing with the fresh results of research. It is safer, therefore, to regard most of this modern work on nutrition as being still in the experimental stage. There will be no certainty with regard to its practical value until it has been tested and applied under farming conditions by experienced stock farmers capable of forming and expressing an opinion. The following account, therefore, especially in so far as it deals with the practical application of the scientific information which has been obtained in research work, should be regarded as an expression of views rather than a statement of fact. The reader should consider the views or statements set forward here in the light of his own practical experience, and if he should think it worth while attempting to apply any of the information in practice, he should do so as an experiment, noting the results with an open and critical mind. There is a great need at the present time for practical experimental work of this kind carried out on farms to test the value of some recent research, and also to serve as a guide for further research effort in laboratories.

Vitamins Generally.—Fresh foodstuffs in the natural state contain, in addition to carbonaceous material, proteins and salts, certain substances and properties termed "vitamins" which are essential for health and growth. An example of these is the antiscorbutic, which is present in fresh fruits and vegetables, and which keeps the body free from scurvy.

One of the most remarkable features of vitamins is the fact that minute quantities produce profound physiological effects. Thus, less than a ten-millionth part of an ounce per day of irradiated ergosterol, a substance which contains Vitamin D in high concentration—if indeed it be not actually Vitamin D itself—is sufficient to keep rats free from the disease which develops in the absence of this vitamin. The amounts of vitamins necessary to maintain health are so small and are so widely distributed in foodstuffs that it is difficult to make up vitamin-free rations. It is usual in vitamin studies to work with synthetic rations, *i.e.*, combinations of specially purified foodstuffs, artificially freed from vitamins.

It is obvious that vitamins do not provide any appreciable amount of energy or heat or of constructive material for the formation of body tissues. Most probably they act by stimulating certain physiological processes. It is possible that they affect the activities of the ductless glands, which produce substances of which small amounts have a profound effect upon growth and health.

Another interesting feature of vitamins is that it has been found astonishingly difficult to isolate them. They can be concentrated in extracts, but as the separation of the vitamins from the other constituents proceeds, the vitamins tend to disappear, or, in other words, the concentrated substance loses its vitamin property.

The vitamins which have been chiefly studied are: Vitamin C, which prevents or cures scurvy; Vitamin B, the absence of which leads to disturbance of the nervous system and the digestive organs; Vitamin A, which is necessary for growth; Vitamin D, which specially affects the metabolism of calcium and phosphorus, and is therefore of importance in the growth of bone; and Vitamin E, the absence of which causes sterility. Recently another vitamin named "G" has been discovered. It appears to have an effect on growth and in maintaining a healthy condition of the skin and mucous membrane of the mouth.

With vitamins should be included the effects of irradiation with ultra-violet light. The invisible light waves beyond the violet end of the spectrum, when directed upon the surface of the body, produce the same beneficial effect as Vitamin D. When directed on foodstuffs containing a substance known as ergosterol, the foodstuffs acquire the properties of Vitamin D. Ultra-violet light is contained in direct sunlight. It can also be produced artificially by certain kinds of electric lamps.

The chief pathological conditions which develop when the various vitamins are not present in the diet have been indicated above. The evil effects of vitamin deficiency are, however, not limited to these gross disorders. Diets or rations may contain sufficient of any vitamin to prevent the onset of these gross symptoms of disease, but still not contain sufficient for the maintenance of perfect health. Thus a diet may contain sufficient of Vitamin B to prevent the onset of the typical symptoms of beri-beri, but not sufficient for perfect health, and the animal, though not showing the signs of beri-beri, might still suffer from imperfect functioning of the digestive organs and a resulting degree of general malnutrition.

Fortunately, all natural foodstuffs are comparatively rich in most of the vitamins. Thus, fruits and vegetables, grass, roots and tubers, are especially rich in Vitamin C. In cereals, Vitamin B is contained chiefly in the seed-coats. Hence, all whole grains or offal are rich in Vitamin B. Green food, such as grass, is rich in all vitamins, and is especially rich in both Vitamin A and Vitamin D. Vitamin E is also widely distributed in foodstuffs.

The danger of vitamin deficiency arises on diets or rations consisting of materials which form only a part of the natural foodstuff, as, for example, wheat flour or polished rice. In both these cases the vitamin is removed in the process of milling. Cooking tends to destroy the vitamins; hence foodstuffs which have been cooked and preserved are, in general, poorer in vitamins than fresh foodstuffs.

Most of the experiments which have been made to determine the amounts of vitamins present in different foodstuffs, or the effects of the absence of vitamins, have been carried out with small animals, *e.g.*, guinea-pigs and rats, fed on special diets consisting of substances from which all the vitamins naturally present in the original foodstuff have been removed or destroyed. The results of these experiments, while of great scientific interest, have, of course, no direct bearing on stock farming, because the kinds of rations used in these experiments would never be used on a farm, and, further, because the requirements, for some of the vitamins at least, are not the same for different species of animals. The only experiments of immediate practical value for stock-feeders are those done on farm animals with rations such as would be used on a farm. Fortunately, a number of these have been done. The practical bearing of these may be considered under the heading of the different vitamins.

Vitamin C.—The only animals that seem to suffer to any marked degree from deficiency of this vitamin are monkeys, men and guinea-pigs. There is, therefore, no evidence that it is of great practical importance in stock farming. It has been shown that cattle and poultry do not suffer from deficiency of Vitamin C in the food, and tests with pigs have shown that they can remain in good health without any sign of scurvy for at least three or four months, though fed on a diet devised to contain as little of the vitamin as possible.

The writer is not aware of any definite tests having been done on horses. On the other hand, he has not seen any

reports indicating a wide occurrence of scurvy among them, although many horses are fed for long periods on rations such as hay, oats and other grains which have little or no Vitamin C. It is possible, of course, that though gross signs of scurvy may not appear, deficiency of this vitamin may be the cause of a minor degree of malnutrition which, if long continued, may manifest itself in increased susceptibility to other diseases. It would be interesting to compare the condition and freedom from disease of town horses which regularly receive some foodstuff rich in Vitamin C, *e.g.*, roots or tubers, with others not receiving this, but on an otherwise similar diet.

Vitamin B.—This vitamin, which prevents beri-beri, is so widely distributed in foodstuffs, *e.g.*, grass, wheat offal, grains, roots and tubers, that there is little likelihood of a deficiency in any ordinary ration. Further, the results of a number of tests with cattle carried out by Sir Arnold Theiler in South Africa show that it is a matter of considerable difficulty to produce any signs of deficiency of this vitamin in cattle, even with rations specially prepared to be as free as possible from it.

Fowls are especially susceptible to beri-beri, but as the foodstuffs used for poultry consist largely of wheat offal and grains, the danger of deficiency of Vitamin B is not great. Yeast is especially rich in this vitamin, and the addition of yeast to poultry rations has been advocated as a means of providing a rich supply. Yeast is rich in protein and mineral matter, which are required in large amounts by laying hens. The addition of yeast to ordinary rations is likely to be of value, even though an additional supply of Vitamin B is not required, but in tests carried out with well-balanced rations containing sufficient protein and mineral matter, the addition of yeast to the ration was not accompanied by any increase in eggs or better health in the fowls.

Vitamins A and D.—The two vitamins which seem to be of greatest importance in stock farming are Vitamin A, which promotes growth, and Vitamin D, which promotes healthy growth of bone. For a time Vitamin D was not recognized as a separate entity from A, and the earlier tests were done with substances such as cod liver oil and green food, which contain both. They may therefore be considered together.

Of the two, Vitamin D is probably the more important. Young animals fed indoors in winter are liable to have a

diet deficient in D, with resulting imperfect bony development. It has been shown that if chickens be reared indoors without any sunlight and with no green food they are liable to develop "leg weakness," which is believed to be due, partly at least, to deficiency of Vitamin D. In the same way young pigs after weaning are liable to suffer from rickets, a disease in which there is imperfect development of the bones, and which is liable to occur in young pigs fed indoors on cereal rations.

One of the richest sources of Vitamins A and D is cod liver oil, and the addition of a small amount of this oil to the rations of chicks and young pigs reared in confinement has proved of very definite value in keeping them free from these diseases. Green food, which is rich in Vitamins A and D, will, of course, have the same effect in promoting health. As has been noted above, ultra-violet light, which is available in the sunshine, supplies or replaces the necessary Vitamin D. A run outside, therefore, is in many cases as valuable as feeding substances rich in Vitamin D. It should be noted that fowls kept under ordinary conditions, with an outside run on grass get all the Vitamins A and D they need. Extensive tests have shown that the addition of cod liver oil to rations otherwise well balanced produces no increase in egg yield if fed to fowls kept under ordinary practical conditions with a run on pasture, as most fowls on farms are. In intensive methods of poultry farming, however, when fowls are kept continuously indoors with no green food, the addition of cod liver oil to the extent of 2 to 4 per cent. of the ration would probably have a beneficial effect. Tests in the United States have shown that the addition of cod liver oil resulted in increased egg yield, and increased hatchability of eggs and viability of chicks.

Vitamin E.—Experiments with Vitamin E, which is believed to affect reproduction, have been carried out only on rats. Whether or not deficiency of this vitamin affects reproduction in farm animals is unknown. On the whole, as Vitamin E is so widely distributed among foodstuffs, it is unlikely that under ordinary conditions a marked deficiency would occur. Arising out of the work on Vitamin E with rats, however, sprouted oats have been tried in the treatment of sterility in cattle in America, and to a less extent in this country. There appears to be some doubt as to whether sprouted oats contain Vitamin E, but the experiments made, although inconclusive, indicate a possible beneficial effect. It is said that fertility

has been restored to infertile bulls and the number of services required by cows reduced.

It will be seen that, as far as our knowledge goes, with the exception of Vitamin D, there is not much likelihood of deficiency of vitamins occurring in practice. If, however, deficiency of vitamins be suspected in some rations, vitamin-rich foodstuffs are constantly at the farmer's hand. Green grass, grains, roots and tubers, are easily available. If he wishes something in addition to these, cod liver oil as a supply of A and D, and yeast as a supply of B, can easily be obtained. A dessertspoonful of cod liver oil per head per day should supply sufficient vitamins A and D for large animals, and 4 oz. per 10 lb. of mash are sufficient for fowls. There is no need whatever for any stock feeder to purchase any highly priced foodstuffs merely on account of the fact that they are alleged to be especially rich in vitamins.

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ECONOMIC RESEARCH IN AGRICULTURE*

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RESEARCH in agriculture has been for many years mainly directed to problems affecting the physical life of crops and live stock, and it is only comparatively recently that there has been any general recognition of the fact that the business side of agriculture is no less deserving of investigation. Even now, current ideas as to what is meant by economic research in agriculture are usually somewhat vague, and my object here is to describe briefly some of the directions in which research is being carried on in this and other countries, and to indicate some of its possibilities.

The pioneer country in economic research in agriculture is the United States, and to the example set by it much of the recent advance elsewhere is to be attributed. The work is conducted, not only by the U.S. Bureau of Farm Economics, but also by the State Agricultural Colleges and Universities, and by a number of Research Institutes supported by private funds. The total annual expenditure is estimated at £400,000 and this is being applied to the carrying out of over 450 separate investigations, covering such diverse subjects as costs of production and other aspects of farm management, co-operation, marketing, prices, land settlement, land values,

*A lecture delivered at the London School of Economics, February 5, 1930.

taxation, credit, rural life, etc. This is exclusive of administrative expenditure on the collection of statistics, the promotion of marketing, etc., on which the outlay is much greater. To some extent this development is due to the fact that the study of economics has shared with other subjects in the enormous funds devoted to agricultural research in the United States, but it has been stimulated by the somewhat characteristic American view that by the close study of statistics and similar data, results can be obtained of practical value to the nation and to the individual.

Progress has also been made in Great Britain, though on a much more limited scale, and, since 1913, there have been 11 colleges in England and Wales and 3 in Scotland engaged in various forms of economic research, mainly the collection of data relating to farm costs and advising farmers in regard to farm management. There is also the Institute for Research in Agricultural Economics at Oxford, the activities of which are, however, restricted by the limited funds and staff at its disposal. Marketing is a more recent innovation, investigations having been actively undertaken by the Ministry of Agriculture during the last five years. A good deal of work of the same sort is also being done in the Dominions and on the Continent.

A great stimulus has been given to the subject by the World Economic Conference which met at Geneva in 1927 and pressed the importance of the systematic study of the problems of agriculture as an essential part of the economic problems of commerce and industry. To some extent this has introduced a new outlook, and has emphasized the fact that economic research is not concerned solely with the interests of the individual farmer, but has national and world-wide aims.

Financial Results of Farming.—From this preliminary view of the subject, let us turn to the types of research which are actually being undertaken. One large group of investigations is concerned with the financial results of farming, and is primarily intended to increase the efficiency of the individual producer by analysing costs and methods in such a way as to point out opportunities for improvement. This was the first direction in which research was developed in the United States, and it is the main purpose in this country to-day. Apart from its practical aspect, however, the data collected should be of enormous value in providing an accurate knowledge of the industry.

There are several methods, which fall broadly into three types. Each has its supporters, but there is no complete agreement as to which is the most satisfactory.

(1) There is first the cost accounting method, the object of which is perhaps sufficiently indicated by its name. Cost accounting is not, however, well suited to the complicated business of agriculture, and the detail involved makes this system very expensive and troublesome, so that the number of farms that can be costed is limited. It has, in fact, been built up on the idea of individual service to the farmer, and its special function is to point out directions in which economies appear possible, or in which loss can be avoided.

For example, in a Report by the Department of Agriculture at Cambridge, a case is given where on six farms of analogous character, three were making a large profit on pig-keeping, while three others were making a loss. An analysis of the costs suggests reasons for this variation.

Apart, however, from the costing function, this system gives a complete view of the whole economy of the farm, but its value for comparative purposes is limited by the small number of results which it is possible to obtain.

(2) An alternative system, known as the survey method, has been widely adopted in the United States, and to a limited extent in this country.

This differs from the preceding method in that it aims at obtaining information about all the farms in the area surveyed and does not involve individual costing. On the other hand, the average results are likely to be more typical because of the larger number of cases included; and, by analysing the influence of all the different factors on the profitability of the farms, it is possible to indicate those which appear to result in the greatest efficiency.

An example may be taken from a Report issued last year by the Seale Hayne College, giving the results obtained from 205 farms in Devonshire. On these 205 farms, the difference between receipts and expenditure averaged £49. If interest on the capital employed is deducted there was an average deficit of £5, against which the farmer had the use of the farm house and home-produced food, but no remuneration for his labour and management. This was an average, some of the farms showing a profit and some a loss. By arranging the farms in groups according to the income returned, the relationship between a high or low income and the various factors in management, rent, labour employed, capital and

so on could be examined, and an indication given of the factors which appeared to be associated with profit or loss. One interesting point was that if these farmers paid all their expenses except rent, and were allowed interest on their capital and wages for their labour, there was a balance of £98 available to pay rent, whereas the actual rent they had contracted to pay was £191—nearly double. These figures only referred to one year, and this is a defect from which these surveys usually suffer, viz., that they are commonly only undertaken for one year, which, of course, may be a good or bad season. The area, again, is limited, and may not be typical of the county or district in which it is situated.

(3) A third method, which is much favoured on the Continent, and has been adopted to some extent in this country and in the United States, is that of financial accounts. Books on a prescribed system are kept by selected farmers with some supervision by local Associations or Agricultural Colleges, the results being tabulated at a central office. The accounts are moderately simple in character so that a considerable number of results can be obtained without too much expense.

A distinction between this and the other two methods is that *annual* returns are usually obtained, the results being classified under uniform headings which can be compared from year to year. This annual comparison gives the figures quite a different value to what they would possess as isolated results. Changes can be correlated with fluctuations in prices and other factors, and these financial results begin to assume a statistical character. In addition, by making a suitable selection of farms spread over a whole country, or typical of particular methods of farming, results can be obtained which, owing to their representative character, allow general conclusions to be drawn.

These three systems have a general family likeness though there are differences of opinion as to their relative advantages and as to the exact methods to be adopted. They are all intended to assist the farmer in the management of his business, the object being to point the way to greater efficiency in production methods. They help farmers to understand and to realize the financial results of their operations. For instance, in the example quoted, the small average profit is evident, but it was probably not known or appreciated in any exact way. These men would say they were doing badly, and would probably regard it as an "Act of God." They

would certainly not have the means of studying possible causes and possible remedies.

Thus, the ultimate value of investigations of this kind lies in their tendency to eliminate sub-marginal farming, to discourage the continued cultivation of crops which are not permanently profitable, and generally to raise the average level of farming.

There is a great need, however, for an exhaustive study of method; and for agreement as to what are the fundamental facts which it is desired to obtain, and how they should be got. This need for an agreed method was very strongly emphasized at the World Economic Conference, which, after declaring that "the fundamental importance of agriculture demands an exact knowledge of its economic situation," and that "such knowledge can only be gained satisfactorily through a methodical analysis of farm accounts," went on to say that: "To achieve this purpose it is desirable that in the different countries an exact system of farm accounting should be formulated. These accounts should be drawn up in every country as simply as possible, but by the method ensuring the greatest guarantee of accuracy so as to obtain comparable results."

Efforts have been made by Professor Laur (Switzerland) to secure uniformity in the Continental systems, and, as a further basis for discussion, a Report is being issued by the International Institute of Agriculture at Rome describing in detail the various methods adopted on the Continent and elsewhere. The methods adopted in this country also demand examination, particularly in the direction of securing annual comparative returns.

The problems that can be studied through the medium of such representative returns are important. In the first place there is the study of the agricultural income. What is the return obtained by farmers for their labour and capital, and what are the differences in various farm enterprises? How does this compare with that obtained in other industries? Or, to take another aspect of the agricultural income, what is the total return obtained from the cultivation of the soil, and how is it distributed between the various contributing parties? That is, what is the net return obtained by the landlord, less outgoings for repairs and maintenance; the net return obtained by the farmer as interest on capital and reward for his own labour; the remuneration of hired labour; and the share of the State or local authority in the form of

rates and taxes? Again, what is the relation of rent to costs of production? How far is rent raised above its proper level by competition among farmers for opportunities of employing their labour and capital?

More exact knowledge on these points would contribute to the solution of the problem of agricultural depression and allied problems of ownership and tenancy, family farms, small holdings and large-scale farming.

The fundamental point in these problems is one of profitability—that is, of the return obtained for the expenditure of labour and capital—but they have to be discussed at the present time without that statistical basis which is so necessary as a corrective to current observation and report.

Great progress would be possible if we were in possession of annual statistics of the financial results of farming. These would not only be valuable in themselves, but, when correlated with other agricultural statistics—such as changes in acreage and live stock, prices, population, etc.—would throw light on economic movements and tendencies, about which at present we know but little.

Apart from the returns so far available in this and other countries, our main information as to the relative prosperity of agriculture is derived from a study of index numbers of comparative prices. For instance, very extensive use is made of the index numbers of the prices of agricultural products. They can be compared with the prices of commodities generally or with the cost of various outgoings involved in production. Another comparison of this sort, which has been particularly used in the United States, is to test the purchasing power of sums received for agricultural produce as expressed in terms of commodities which the farmer has to buy, the value of the "farmer's dollar" as it is called. For example, taking the pre-war average as 100, the index number of farm prices in the United States in 1929 was 136, of non-agricultural wholesale prices 149, and the retail prices of commodities normally bought by the farmer 156.

Figures of this kind are very useful, but they are, after all, only approximations, and what is needed is more information as to the actual financial results of farming, which can be compared with index numbers and used in the same way.

Organization of Labour.—Another line of investigation which is also part of the economics of production is that directed to the scientific organization of labour. Research in this subject is undertaken to some extent in Great Britain

in connexion with farm management inquiries, many of which aim at ascertaining, by comparison between different farms, the most efficient methods. A few studies have also been made by Mr. W. R. Dunlop in connexion with the National Institute of Industrial Psychology on the lines of the Taylor system for testing the time and effort expended in manual and other labour. This question is, however, receiving more attention in Germany and in some East European countries —Poland and Czechoslovakia—where labour problems are of paramount importance. It covers both an exact study of processes—the time taken to perform a certain task, or the output under varying conditions, the effects of fatigue and so on—and also the practical and human side of establishing the best relations between the employer and worker. One result has been the increasing tendency towards piece work and the payment of bonuses at definite rates for work above a basic standard, and the fact that research in this subject is actively supported both by the agricultural organizations and the farm workers' unions is evidence that it is regarded as equally beneficial both to employer and worker. As the cost of labour in Great Britain is perhaps the most pressing problem the farmer has to face to-day, there cannot be much doubt as to the need for research in this direction.

Rural Sociology.—Another group of investigations connected with production may be mentioned, such as standards of living, conditions of country life, movement of population, the rural psychology, etc. In the United States, considerable stimulus has been given to studies in rural sociology owing to the fact that the Purnell Act of 1925 provided funds specifically for "economic and sociological investigations having for their purpose the development and improvement of rural home and social life." Not much has been done in this direction, so far, in this country, though the subject has not been entirely overlooked.

Research in Marketing.—So far we have been considering factors in the economics of production. Let us now turn to the disposal of the product.

Producers in the past have been apt to think that their business was finished when the produce passed out of their hands. Individually this is, of course, the case, but the price received by the producer and the demand for future consignments are both affected by the efficiency of the organization engaged in handing it on to the final consumer. For this

reason, research in marketing is concerned with all the operations of the trade in agricultural products.

As an example, let us consider for a moment what is involved in an attempt to survey the marketing conditions of wheat. We have to take, first of all, the world position and its relation to the home crop, the imports and total supplies, and their variation from year to year; the various kinds, qualities and descriptions of grain included under the general heading of wheat; the demand for human consumption and other purposes; prices, their trend and seasonal and local variations; the preparation and assembling for market; storage and transportation; and methods of grading and standardization. Then we come to actual distribution, the sale by farmers to various intermediaries, retail and wholesale markets, the flour milling and baking industry, etc.

The enormous range of such an inquiry is obvious. To bring it to a successful conclusion, even as a description of the operations involved, needs the goodwill and assistance of people in many branches of business, each of whom may be an expert at his own calling, but may have very little general knowledge of other sections. Moreover, each different commodity has its separate problems.

Market studies were first developed in the United States and are still being conducted on an extensive scale. More than one-fourth of the various research inquiries in the United States are concerned with some aspect of marketing. Recently in this country, great progress has been made by investigations conducted by the Ministry of Agriculture, and reports have been issued covering most of the principal commodities. Not only has the actual mechanism of marketing been closely studied, but an attempt has been made to point out the weaknesses and defects of the existing system with a view to encouraging the adoption of improved methods. These investigations have disclosed the complicated nature of the problems involved. They have also emphasized the value of inquiries of this sort in placing before farmers and traders that general view of the position of the industry which it is not possible for the individual to gain for himself.

More important still, they have been the means of introducing into the agricultural industry in this country the distinguishing feature of the principle of grading and standardization, which characterizes most of the imported produce with which the British farmer has to compete. These inquiries have been supplemented and

extended by similar investigations carried out by the Imperial Economic Committee. Surveys of this kind, however, form only the preliminary. Almost every aspect of marketing needs special study by itself.

Co-operation.—There is, for example, the highly complex question of the cost of marketing at its various stages, the price structure and the distribution of the margin between producers and retail prices. This involves the whole problem of the efficiency of the machine, and leads up to the study of co-operation as an alternative method of marketing.

There is here a vast field for research, not as to the theory of co-operation, but as to the possibility of its application in practice. Whereas co-operation in the sale of agricultural produce is advancing in most of the principal countries of the world, it is practically stationary in Great Britain. It may be that the fundamental principle of co-operation—that is, joint action and collective responsibility for mutual benefit—is psychologically unsuited to the British temperament. Or it may be that the margin between producers' and retailers' prices is not, in fact, sufficiently large to enable a co-operative business to show any material saving after paying for the cost of efficient management. This is where the detailed investigation of the methods and costs of marketing becomes of importance.

Again, even if the small co-operative society is able to offer little if any financial advantage over the private trader, experience in other countries suggests that a federation of co-operative societies controlling a substantial portion of the supply is a form of marketing which offers great advantages to the agricultural community. The typical example of this is found in the Wheat Pools which are now operating in Canada and in a number of similar organizations for other products which have been established in the United States and elsewhere. These large-scale organizations, in spite of some setbacks, are undoubtedly extending and growing in importance. They imply an alteration in the present system of marketing which, if it could be more universally adopted, might alter the economic position of agriculture.

The counterpart is the co-operative purchase by consumers, and the two taken together offer the possibility of a more rational adjustment of supply to demand. It is no more than a possibility, for the application of large-scale marketing to agriculture is in practice full of difficulties.

In any case, the study of systems of market organization is a very desirable and important branch of research.

Supply and Demand.—Studies of marketing organization involve the investigation of problems of supply and demand. Our main knowledge of supply is derived from the statistics of agricultural production, imports and exports, which provide a general view of the situation and are the basis of the existing commercial efforts to relate supply and demand. There is ample scope here for "research" as distinct from the mere examination of published figures, and as an example may be mentioned the series of Wheat Studies issued by the Stanford Food Institute of California. A particular aspect of these statistical returns which has not received sufficient attention is the varying influence of supplies from different sources on price, as affected by quality, season, cost of transport and similar factors.

Each commodity and each country and district presents its own problems—the local distribution of supply, the disposal of surplus on alternative markets, the seasonal movement of produce, and so on—and for the study of these it is necessary to collect statistics and information locally.

The investigation of demand is the counterpart of supply, and is equally important. We have only to think of the fluctuations which have taken place in the demand for wool and cotton, hops and barley, to see the need for studies of consumptive demand and its reactions on supply as regards quantity, quality and price.

Price.—Although supply and demand need to be studied separately, they are more usually approached through the medium of price, and special attention has been given to this subject in the United States, where price studies are being carried on with considerable vigour.

Broadly speaking, the attempt has been to correlate price and supply, and to endeavour to define and measure the factors which give rise to a change in price. In particular, attempts are being made to establish a statistical basis for predicting the average price-tendency of a product for the coming year or marketing season, the object being to guide farmers in their future operations. Advanced mathematical methods are used, and naturally this work has been the subject of much criticism. It is analogous in character to weather forecasts, and although precise and exact predictions cannot be expected, a general indication, based on a consideration of all the factors, ought to be of considerable value.

This type of study is still in the experimental stage, and its value is not to be judged entirely by immediate results. It should rather be regarded as a foundation for the future, and whilst there are limitations to the employment of these methods, it seems fair to expect that, on the average, the mathematical study of the relationship between prices and supplies and other factors will give better results than are obtained merely by what may be called general observation and simple deduction.

This form of investigation has been applied by the United States Department of Agriculture in its "outlook" report. This aims at giving to farmers, on the basis of the best available information and analysis, an indication of the situation as regards production, consumption and prices of the principal crops and kinds of live stock, and the probable tendency, combined with recommendations or suggestions as to expansion or restriction. Its value lies in the fact that it is an attempt at securing an adjustment of supply to demand. It presents many difficulties, but at least it possesses an underlying principle which is of value.

Another type of inquiry is the relationship between quality and price. Although, in wholesale markets, quality is more or less definitely recognized, this is not always the case in markets where produce is sold direct from the farm, and it is a common view among producers that for many products quantity is the main point. That is to say, the extra price, if any, which is obtained for superior quality is not sufficient reward for the trouble involved in producing it. For example, in the case of wheat in this country it is said that the newer varieties, such as Yeoman, which produce a superior type of flour, do not usually secure recognition in the ordinary country markets. Probably the reason is that the quantities offered at any one time are not sufficient and are not standardized or true to type. It is, however, an example of a case where studies into the relationship between price and quality might be of value.

There are many other forms of price investigations. The effects of changes in the value of money on agricultural prices may be mentioned as an example. This perhaps is not strictly a question of agricultural research, though unless the value of money itself can be stabilized, the fluctuations in the prices of agricultural commodities cannot be regarded as due merely to fluctuations in supply and demand, and the problem, which

in itself is more than sufficiently complicated, may become insoluble.

Summary.—I have now reviewed in a very superficial manner some of the directions in which investigations are being undertaken. They are all in the experimental stage, but the different lines of inquiry, as they are expanded and developed, may dovetail into one another and form a coherent whole.

We have, first of all, the intensive investigations into the actual operations of farming which provide an indication of profitability in relation to the capital invested and the labour employed. These lead to more efficient farm management, prevent waste, point out alternative methods and contribute to the adjustment of costs of production to prices. By showing where the return on capital and labour is low, they tend to the elimination of sub-marginal farms, or forms of cultivation which have ceased to be profitable. Again, a knowledge of the financial results of farming from year to year would prove a valuable counterpart to studies of movements in prices and trends in agriculture. It is the necessary basis for a solution of the problem of agricultural depression.

Allied to this is the study of the organization of labour. The disparity between the wage level and the price level is to-day perhaps the most important factor in agriculture, and the better utilization of man-power is one means by which this disparity may be lessened.

Marketing inquiries enable us to see how far the business of selling agricultural produce is efficiently conducted. One stage is increasing standardization and a higher average quality of produce. Another may be organized sale by large co-operative units.

It must be borne in mind, however, that in proportion as improved marketing methods are successful from an agricultural point of view, they result in a better return to the farmer. This has the result of stimulating production, which, in the absence of a constantly expanding market, is bound ultimately to cause an over-supply, and thus to depress prices and nullify the previous success. It is this economic difficulty which cuts at the root of so many otherwise promising schemes. It is one danger in attempts at price stabilization. If the latter is to have any scientific economic basis it involves also the stabilization of production in relation to demand.

Marketing organization, then, cannot be considered by itself. Its corollary is the investigation of problems of supply,

demand and price, and the question to be solved is whether a better understanding of the reactions of one on the other can point the way to a better adjustment. Over-supply due to exceptionally bountiful yields cannot be foreseen, but it is possible that over- or under-cultivation or breeding might be influenced and partly controlled by greater knowledge. The co-ordination of purchase and sale between large co-operative organizations also seems to offer possibilities of regulating production to some extent.

It is to aims such as these that economic research in agriculture can contribute much.

The subject looked at as a whole is one of first-class importance. Agriculture is the occupation of the majority of workers throughout the world, and the quantity of food stuffs and raw materials produced is one of the factors which determine the maximum limit of industrial development. We are only in the initial stages of tracing the relationship between production and prices, and results cannot be expected at once; but the more economic research is developed the more we shall be able to judge of the possibility of reaching some co-ordination between purchase and sale, of securing that better adjustment of supply to demand which is necessary to prevent gluts and shortages, and to prevent the waste of capital and labour in agriculture throughout the world.

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MARKETING AND THE NATIONAL MARK*

THE agricultural industry is not one but many industries, and it is customary to refer to the fruit industry, the egg industry, the beef industry, the dairying industry and so on; there are also the dependent manufacturing industries, such as the bacon industry, the cider industry and the beet sugar industry. Each of these commodity-industries has its own intricate marketing problems, and it is, therefore, difficult to review in narrow compass the vast and almost limitless subject of agricultural marketing as a whole.

It is a common notion that the methods of marketing home agricultural produce are inefficient. They are—judged by certain criteria—but they are not more so than those employed in other countries that are mainly importers of agricultural produce. There are, in fact, two main weaknesses in our marketing arrangements; our home products are not offered in standardized form in the distributive trades, and our various commodity industries are not organized for marketing on national lines. To a large degree, organization waits on standardization, and it will, therefore, be convenient to consider the latter first.

Standardization.—Although with our easily accessible markets the incentive to standardize our products is less than is the case with imported produce, the fact that our products have to compete in the densely populated areas with selected goods from abroad makes the need for grading and packing our products to national standards, and for an efficient marketing technique, at least as great as in the case of imports. Obviously, however, our task is more complicated than that of our competitors, at any rate as regards raw products.

What are the commercial advantages of standardization?

(i) It facilitates the physical process of buying and selling and so reduces marketing costs.

(ii) It makes possible the practice of buying on description, and, for most products, eliminates the necessity for, and, therefore, the expense entailed in, inspection before purchase: the distributor can give his order by post or telephone.

(iii) As the Linlithgow Committee pointed out, it is the foundation of successful advertisement.

* An address given by Mr. A. W. Street, C.I.E., M.C., Assistant Secretary, Ministry of Agriculture and Fisheries, at the Farmers' Club, March 3, 1930. A full account of the meeting, with the address and discussion, will be found in the *Journal of the Farmers' Club*, March, 1930, price 2s. 6d.

(iv) In the movement of produce over long distances, it facilitates the adjustment of supply to demand, both in the direction of movement and in the rate of flow; it thus reduces price fluctuations and marketing risks, while

(v) the standardized article affords a satisfactory basis for the advance of credit.

(vi) It eliminates the waste which is involved in the payment of carriage and storage charges on low-grade supplies, which are best disposed of locally.

(vii) It makes possible comparable price quotations as between one market and another.

Standardization is, in fact, the basis of large-scale business under modern competitive conditions, and since standardized imports lend themselves readily to the large-scale handling which is necessary if our densely populated areas are to be provisioned in an efficient manner, it is difficult to see how, as these areas expand, the home producer is to prevent his share of their valuable trade from growing less, relatively if not absolutely, unless he contrives to ensure that his produce is presented for wholesale distribution in standardized bulks. Further, supplies which present difficulties in handling are not likely to be pushed by retail distributors, and the retailer counts for a lot in this matter.

Apart from its necessity as a business weapon, and from the advantage which it confers on producer and on national economy by conducing to the elimination of waste in various forms, standardization offers the further advantage that, through the influence of differential prices according to grade, quality-production is stimulated—and, of the total output of a product, the proportion which commands the best prices tends steadily to increase. Similarly, the advantages which are obtained by the graded article lead producers to realize the desirability of greater uniformity in production, and to reduce the range of kinds and varieties produced.

The National Mark.—The Agricultural Produce (Grading and Marking) Act, 1928, provides a means of applying standardization to our marketing. It is a voluntary, enabling Act, of which advantage need not be taken unless desired. Under the Act, the Minister of Agriculture may prescribe and define grades, and he may also prescribe marks to indicate the grades. Anyone may use the grades, but no one may apply the marks unless authorized to do so by or on behalf of the Minister and authorization is only granted subject to the

observance of certain conditions designed to ensure the efficient grading, packing and packaging of the article. In schemes so far formulated, the various marks differ only in the grade-names associated with them, a design now known as the "National Mark" being common to them all.

The principle of the "trade mark" is thus made use of on a national scale. The object of a private trade mark is to guarantee to the buyer that the produce sold under it is the output of a certain individual or firm. It acts as a guarantee of quality, always provided the buyer knows that the owner of the trade mark can be relied upon to maintain certain standards. A national mark, the use of which is granted by the State only to those who undertake to maintain the standards laid down by the State, and who are subjected to a system of impartial checks and controls for that purpose, is the most effective form of trade mark or brand name that can be devised. At the same time, the use of a national mark need not efface the individuality of a product or of its presentation. There is room for the use of names, brands or marks in conjunction with a national mark. Such means of identification are, in fact, used by many packers of National Mark goods. Where this is done, while the National Mark indicates that the produce packed under it is of home origin and attains a defined minimum of quality, the private marks may denote further degrees of excellence above the minimum.

Standardization marks of various kinds are common on imported supplies, but hitherto they have generally failed to connect at the consumer's end. Our competitors have been content to educate the urban distributor to the significance of their marks and standards. Now, however, the tendency is to go further and convey this information, in various ways, to the consumer, a tendency which is likely to be accentuated when an imported article is required to bear an indication of origin. Hence, the two steps in one which are being taken through the National Mark. The National Mark is to the distributor in our large towns and cities an outward and visible sign of standardized grading and packing, and, at the same time, it carries to the consumer a guarantee of home origin and high quality. Further, the attachment of the same National Mark to one home product after another, as commodity-schemes mature and are brought into operation, has the effect of enabling all the commodities so marked to profit collectively by the publicity accorded to each, and to share in the accumulating goodwill of a Mark which is already

in wide circulation and will, in time, be familiar to every housewife in the large consuming centres of this country.

The National Mark policy thus aims at stimulating demand for home produce in the ever-widening populous areas, and at the adoption, by or on behalf of the home producer, of the marketing methods which alone will make it physically possible for that demand to be met. Given a better demand among urban consumers, and also a marketing technique which will broaden outlets and ensure the rapid movement of supplies through the channels of trade, the effect must be to draw off increasing quantities of produce from the producing areas, to relieve the pressure of supplies on country markets, and, generally, to lead to a free expansion of productive activity, and so to more employment at home. Apart from its national advantages, it is important to note that such a policy benefits *all* home producers of the article concerned, whether or not their supplies are marketed under the Mark and wheresoever their marketed supplies are consumed.

Various Commodity Schemes.—Seven commodity schemes have, so far, been operated under the Act, and, although these are by now familiar, it may be of interest to pass them briefly in review. They are the result of collaboration between the Ministry of Agriculture and the National Farmers' Union with the support of other organizations concerned, and they are administered by the Department with the aid of expert Committees.

Apples and Pears.—The Act was first applied to the 1928 commercial crop of apples and pears, and the scheme has now run for two seasons with satisfactory results. About 70 large growers and packers are now on the roll, and nearly 400,000 National Mark labels have been issued since the scheme began. The scheme is designed chiefly to improve our domestic arrangements, but it may be mentioned that small quantities of National Mark apples and pears have been exported to South Africa and Scandinavia and of pears to Paris. Large quantities of pears have been exported under the Mark to Northern Ireland and the Irish Free State. The scheme has convinced growers of the need for producing better quality fruit to match the Mark, and an improvement in this direction is already noticeable.

Eggs.—The second National Mark scheme was the egg scheme, which was inaugurated a year ago. Owing to their quality and superior service, National Mark eggs have secured

the premier position among home-produced eggs on the large wholesale markets. They have also secured entry into public institutions and other quarters where previously dependence was largely placed on imported supplies. The effect has been favourable to the general price level of the home product. It has been estimated that the higher country prices ruling in 1929 compared with 1928 represented a cash gain to the home producer of nearly £1½ million. About 200 million fewer eggs were imported in the year, while the number of young fowls on agricultural holdings in June, 1929, showed an increase of 10 per cent. Other factors, no doubt, contributed to these results—notably the marking of foreign eggs—but those best qualified to judge are satisfied that the National Mark scheme has materially influenced the market in favour of the home producer. About 150 packing stations are now working the scheme, and, to date, over one million box labels and well over two million carton labels bearing the Mark have been issued. A development which may prove to be of great potential importance is the registration, at the end of February, of National Mark Egg Central, Ltd.—a federation of the packing stations which has been formed to organize an improved sales service and to facilitate the bulk offering and widespread distribution of National Mark eggs in the large consuming centres.

Cornish Broccoli.—Next came the Cornish broccoli export scheme, under which, last spring, trial consignments were sent under the National Mark to Cologne and Brussels *via* the Harwich-Zeebrugge Train Ferry, the National Mark grade labels being specially printed in German and French. With the increased area under the crop in Cornwall, and with the organization of a broccoli grading and packing station, further shipments will, no doubt, be made this year if market conditions abroad are favourable.

Tomatoes and Cucumbers.—The fourth scheme, which related to tomatoes and cucumbers, was launched in April, 1929. The packers numbered 76 for tomatoes and 23 for cucumbers, and represented about 250 acres of glass. Over half a million tomato and cucumber labels were issued. A number of packers, for various reasons, failed to make the fullest use of the scheme, but it is anticipated that the position will improve in this respect in the coming season.

Wheat Flour.—Then came the All-English wheat flour scheme in October, 1929. The scheme has enjoyed the support of the millers from the first, and 168 millers and packers are

enrolled. Over 400,000 National Mark sack labels (140 lb. and 280 lb.) and nearly one and a-quarter million small packet labels (1 lb., 1½ lb., 3 lb., etc.) have been issued to date. Approximately one-third of the orders for small packet labels are "repeat" orders. Demand is keen in areas where millers and packers are able to supply National Mark flour in packets of the sizes usually taken for family use. A Walthamstow baker finds his flour trade more than doubled since he began to sell National Mark flour. A Manchester packer is selling 10,000 packets a week. A Hertfordshire miller reports that one of his customers, a baker who regularly bakes bread wholly from National Mark "Yeoman" flour, has increased his weekly flour order eight-fold in a short time. A number of bakers, in fact, report a ready sale for this bread. Consistent high quality and the observance of the statutory grade standards are ensured for National Mark flours by the frequent examination and analysis of samples by the National Mark Flour Trade Committee of the Ministry.

Malt Products.—The Malt Products scheme covers two grades of malt flour for use in bread making, and three grades of malt extract—"Pharmaceutical," "Veterinary" and "Bakers," the first two allowing admixture of cod liver oil. The Association of Malt Products Manufacturers considers that, for the purpose of this scheme, its members will require, in the present season, about 60,000 quarters of English barley, which otherwise would not be needed by this trade. National Mark malt products have now been on the market for little more than a month, and it is too early to measure demand. There are 35 firms on the roll, and over a quarter of a million labels have already been issued. The purity and quality of the National Mark malt products, including their diastatic power, is guaranteed by the statutory grades; this is of importance to the medical profession and to bakers, who must have a reliable article of known strength.

Beef.—The National Mark beef scheme, which was given a good send-off by the Prince of Wales, is confined to two large consuming centres—London and Birmingham—the grading and marking being done by official graders. An average of 3,000 sides a week are now being graded and marked for the London area, and 400 in Birmingham. Extensive publicity campaigns have been carried out in both centres. Over 500,000 explanatory leaflets have been distributed in various ways to the public, circular letters under the Minister's signature (60,000 in London and 8,500 in Birmingham) have

been sent to householders, special posters have been displayed by the Empire Marketing Board on 300 hoardings in London and 50 in Birmingham, and a National Mark Beef Week has been arranged for Birmingham to coincide with the British Industries Fair. These efforts will be continued, if necessary, until consumers have been made thoroughly familiar with this new Government service. It is too early to measure the effect either on public demand or on country cattle markets, although the latter have lately shown a marked improvement in prices, due, no doubt, to various causes, but remarkable figures showing increased sales of fresh (National Mark) beef and decreased sales of chilled beef have been furnished by the London Co-operative Society. There is certainly great scope in both London and Birmingham for winning back business for the home producer. In London, for instance, it is estimated that fresh beef represents only about 30 per cent. of the total beef consumed. In this connexion, two interesting points have emerged, namely, that the demand for fresh beef is relatively greater in working-class districts than in middle-class suburban areas, and that London hotels and restaurants are very poor customers of the home farmer.

A National Mark scheme for dressed poultry has been formulated for introduction in June next. Schemes are under consideration for applying the National Mark this year to strawberries, cherries and cider. Next year, other standardized home products will be brought under the Mark as opportunity offers. Grades, but without provision for the use of the Mark, have been promulgated for ware potatoes.

Publicity.—This recital of progress under the National Mark throws into relief the need for sustained publicity—not to induce the public to eat more of this or more of that product, but to divert demand from the imported to the home product. When, as under a National Mark scheme, the producer has a standardized and marked article to offer, the possibilities of successful demand-diversion are very great. The National Mark, it is true, will advertise itself to an increasing extent, and there are many ways, by displays at exhibitions and so forth, by which the State can help, and is helping, to keep the Mark before the public.

This, of itself, however, may not suffice to exploit to the greatest extent the opportunity which the home-producer now has of mobilizing demand in his favour. Circumstances vary from one product to another, but just as, broadly speaking,

every producer of a commodity of gradable quality benefits from the improvements secured by a National Mark scheme, whether or not he makes any deliberate contribution in terms of supplies or personal effort, so every producer would benefit from publicity. Means ought somehow to be devised which would spread the cost equitably over all producers of the article concerned. Can this be achieved in any other way than by the all-embracing organization of producers on a commodity basis?

The Future.—It is impossible to say how remote we are from such developments, but there can be no doubt about the future trend of events. Large-scale organizations, freed from a parochial outlook, could (*a*) not only supervize grading and undertake publicity, but (*b*) they could arrange with wholesale and retail distributors for better methods of shop-display and sale, and (*c*) by controlling the flow of supplies to the trade they could secure more even distribution and avoid local gluts and shortages. As a type, such organization could do much to stabilize market conditions for products which we, at times, over-produce, such as milk and potatoes.

So now, while pressing forward with the work of standardizing our home supplies, in which task a not inauspicious beginning has been made, we must, at the same time, gradually carry the work a step forward by modernizing our marketing organization. A large amount of information is already available, sufficient, perhaps, for the more pressing needs, but the subject is a difficult one, and producers in other countries have given more thought to it than we have hitherto given to it here. Accordingly, with the aid of increased funds from the Empire Marketing Board, the Ministry will shortly carry out specialized investigations into the problems of marketing organization and into the ways in which such problems have been solved abroad, due allowance being made for different conditions. The intention is to match the Orange Books by reports devoted solely to organization studies. The Ministry will waste no time and spare no energy in this work: but while the Department can investigate, demonstrate and advise—in fact, can help in many ways—not for the Ministry will be the higher command in the field. That, when the time comes, will be for the farmers' elected leaders, and they have never yet shirked their responsibilities.

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MARKETING NOTES

National Mark Egg Central, Limited.—Speaking at the Annual Dinner of the London Egg Exchange on Wednesday evening, the Rt. Hon. Noel Buxton, M.P., Minister of Agriculture and Fisheries, emphasized the importance of recent developments in marketing organization as applied to National Mark eggs. With the object of securing more outlets for National Mark eggs and broadening the basis of distribution in large consuming centres, a central co-operative association of National Mark egg-packing stations had been formed which would arrange for supplies of National Mark eggs to be marketed through accredited trade agents in London and certain large provincial cities as circumstances required. The new organization had been given the title of *National Mark Egg Central, Limited.*

There were, Mr. Buxton said, two equally important aspects of the marketing question. The first essential was to place on the market an article of uniform standard quality easily handled by the trade. There should be no doubt whatever as to the quality of the article, so that the confidence of the trade and the public might be secured and maintained. The grading and standardizing schemes associated with the National Mark had achieved that end. The National Mark egg, for example, had now securely established itself in public favour.

The second and no less important requirement was efficient organization on the distributive side. As far as British agricultural commodities were concerned, this aspect of the problem had been, until very recently, an unexplored field, and the Government, feeling convinced that there was wide scope for inquiry and development, had set on foot an active investigation into the problem. The pressure of events in the egg trade, however—the remarkable increase in home production during recent years, the advent of the National Mark egg, the marking of imported eggs—had forced the pace, and it was now within the bounds of possibility for organized markets, such as the London Egg Exchange, to handle the standardized National Mark product in large commercial transactions.

Two years ago, Mr. Buxton said, the appropriate Cabinet Minister to attend a function connected with the London Egg Exchange would not have been the Minister of Agriculture but the President of the Board of Trade, since until very recent times the activities of the Exchange had been concerned entirely with the trade in imported eggs. The reason lay, not

in the unwillingness of agents to handle British produce, but in the fact that the haphazard methods in which English eggs had been placed on the market had made it impossible for the trade to handle sufficiently large quantities of uniform grades, packing and quality to justify Exchange dealings. There would now, however, be accredited agents on the Exchange dealing with home-produced eggs, and the machinery which had been set up would afford a means of marketing successfully the steadily increasing egg output of the poultry industry of this country. This meant that National Mark eggs, which already offered exceptional service to both trade and public, would be brought within easy reach of the smallest retailer in the big consuming centres to whom ease in buying was an all-important consideration.

It was no exaggeration to say that hitherto the Chinese egg had been more accessible to our smaller retailers, who obtained their supplies through the wholesale trade, than the home-produced article. The Government regarded the new development as of the greatest potential importance, and was making a grant towards the administrative expenses of the new Association in its first year. The organization was a piece of pioneer work, and if it developed according to plan—and he saw no reason why it should not—it would, in time, be without parallel in Europe.

In conclusion, Mr. Buxton remarked that National Mark schemes were based on the soundest principles. They had a snowball effect: each National Mark commodity advertised all the others. The Government guarantee of quality was behind the goods, and it was not only helpful to the British producer, it was the soundest common sense for housewives to take advantage of the opportunities which they now had of purchasing eggs, flour, meat, etc., direct from our own countryside. The Government, for its part, would do all in its power to ensure wide publicity and to assist and stimulate efficient organization, and in that direction, he felt, lay hopes of lasting benefit to agriculture and to the country generally.

Note.—The Chairman of the interim Board of Directors of National Mark Egg Central, Ltd., is Captain A. A. Plimpton, of East Yorkshire Farmers, Ltd., Beverley, a packing station promoted by the East Riding Branch of the National Farmers' Union.

National Mark Eggs.—As a result of the comparatively mild season, English and Welsh eggs are now in very heavy supply, and large quantities are also being imported from Ireland and abroad. Prices have slumped heavily in consequence, but it

is a matter for congratulation, in the circumstances, that National Mark eggs, of which 12½ millions were packed in February of this year, continue to secure good prices. The fact that National Mark eggs have maintained their prestige is an indication that the distributive trade appreciate the value of the service attaching to the Mark.

As stated immediately above, the inauguration of an Association of National Mark Egg Packers has now been completed, and the new organization, known as National Mark Egg Central, Ltd., has been registered under the Industrial and Provident Societies' Acts. All authorized packers will be required to become members of the organization by taking up one fully paid share and paying an annual subscription. The income of the company will be derived from members' subscriptions and a small percentage charge upon all National Mark eggs sold through the company's accredited agents. In addition to its activities in regard to the marketing of packers' supplies, the organization will undertake a market intelligence service.

National Mark Beef.—The number of sides of beef marked with the National Mark each week since the week ended February 8, 1930, has been as follows:—

Week ended	*Select*	*Prime*	*Good*	*Total sides Marked (Quarters and pieces omitted)*
		London		
February 15 ..	576	445	28	1,049
February 22 ..	525	508	39	1,072
March 1	553	481	17	1,051
March 8	603	366	26	995
		*Birkenhead**		
February 15 ..	8	164	36	208
February 22 ..	13	139	24	176
March 1	6	122	10	138
March 8	6	136	11	153
		*Scotland**		
February 15 ..	1,920	158	—	2,078
February 22 ..	1,955	190	—	2,145
March 1	1,993	199	—	2,192
March 8	2,193	276	—	2,469
		Birmingham		
February 15 ..	39	358	20	417
February 22 ..	28	370	45	443
March 1	76	459	61	596
March 8	80	367	35	482

* Sides consigned to Smithfield Market, London.

A second publicity campaign was undertaken in London and Birmingham by the Ministry in conjunction with the Empire Marketing Board during the week commencing

February 24. The Minister addressed a letter to 50,000 women householders in the West of London, and enclosed a list of butchers in the area selling National Mark beef; this communication stimulated widespread interest, and was followed up by visits of the Ministry's Grade Inspectors to the butchers in the area. The number of shops on the roll of London meat traders had increased on March 1 to 1,157, as compared with 1,029 before the campaign. The total number of sides marked for the London area during the week ended March 1 amounted to 3,381, as compared with the weekly average of 3,262 for February, 2,733 for January, and 2,784 for December. As a result of the canvassing of hotels, a leading hotel company in the West-end of London has undertaken to supply National Mark beef.

In Birmingham, the campaign was well supported by the Lord Mayor and other eminent persons in the city. The Minister's letter was addressed to some 9,000 women householders in one area of the city, and, as a result of the public interest shown, the number of sides of home-killed beef marked in Birmingham during the week ended March 1 rose to 596, as compared with 381, the weekly average for January. A competitive window shop display in the city received an entry of over 40 butchers. A photograph of the winning display faces this page.

There has been a distinct change in the attitude of the trade towards the National Mark beef scheme. There have always been supporters of the scheme, both amongst wholesalers and retailers. Early in December, many more traders began to give the scheme a trial, but now it is exceptional to find a meat trader who is definitely opposing it. Traders *do*, however, urge that, as they are doing their best to make the scheme a success, a similar effort should be made by the farmers. So long as supplies from the producing areas include a number of rough, ill-bred cattle, the task of the butcher who is trying to help the sale of home-killed beef, through the National Mark, is rendered unnecessarily difficult.

As was pointed out in the Ministry's Report on the Marketing of Cattle and Beef (Economic Series No. 20), one of the most important points in the meat trade is regularity of quality in supplies. The prospect of recapturing the best trade for home-killed beef must, therefore, depend on a high and regular average of quality—*i.e.*, on some measure of standardization. Admittedly, this is a difficult matter, since live cattle cannot be standardized as readily as eggs, fruit and vegetables can

as Marketing Leaflet No. 16. This report recounts the general activities of the Council since it was constituted, and contains a statement of its more important findings in the fields of production and marketing. The Council has devoted considerable thought to the question of the production of the right type of commercial pigs, and its main recommendations on this point were given in its first Interim Report, which was published as Marketing Leaflet No. 15. Copies of both Interim Reports (Marketing Leaflets Nos. 15 and 16) may be obtained, post free, on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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THE FERTILIZERS AND FEEDING STUFFS ACT, 1926

SOME QUESTIONS AND ANSWERS

THE Fertilizers and Feeding Stuffs Act, 1926, came into force in July, 1928, and, during the first eighteen months of its operation, numerous points have arisen touching its scope and requirements. Most of these points involve questions of interpretation of the Act. In all such cases, the Ministry has, of course, been unable to do more than express an opinion, since the interpretation of Acts of Parliament is a matter for the Courts of Law. It has, however, been thought that the following selection from among the questions put and answers given may hold a certain amount of general interest :—

Statutory Statement.—In response to an early inquiry regarding the form of the statutory statement, it was explained that no form had been prescribed and that it was, therefore, open to sellers to give the particulars required by the Act either in the invoice or by any other suitable means.

A specific case bearing upon the same point was put in respect of dried sugar beet pulp. A firm asked whether, in addition to labelling each bag with the required particulars, they were obliged to include these particulars in the invoice. They were informed that, if the labels contained all the particulars required to be given in the statutory statement, and these were allowed to remain on the bags and were in a legible condition when received by the purchaser, the requirements of the Act in respect of both giving the statutory statement and marking the parcel would be satisfied.

A local authority, which manufactured a certain amount of fish manure, inquired whether it would be sufficient merely

to include the analytical particulars in the invitation of tender. The opinion expressed was that this would not, in itself, constitute compliance with the Act. It was suggested that the particulars should be furnished in some written document sent to the purchaser after the sale, or on or before delivery.

A correspondent asked whether it was legally correct to state a range of percentages, instead of a single figure, in respect of the valuable ingredients, as, for example, "oil 8-10 per cent." The Ministry expressed the view that this would not comply with the Act, but that a single figure, if correct within the limits of variation, was sufficient.

Marking of Parcels.—Some uncertainty was found to exist in a number of quarters on the question whether individual sacks, or other packages, were required to be marked with particulars of analysis when received by the purchaser. The view which has been taken by the Ministry is that, while many packages will, in practice, continue to bear the mark at the time of delivery, there is no legal requirement that they should do so.

A firm selling fertilizers in small packages was under the impression that each "small quantity" within the meaning of the Act had to be marked with the necessary particulars in half-inch letters and pointed out that it would be impracticable to mark 1 lb. bags in this way. It was explained that the half-inch letters prescribed in Regulation 1 of the Fertilizers and Feeding Stuffs Regulations, 1928, relate to the label or show-ticket displayed on the sack or bin from which small quantities are sold, not to the wrappers of the small quantities themselves.

Advice was sought also with regard to the sale of horticultural fertilizers made up in bags of 7 lb. and multiples of 7 lb. The name of the fertilizer was branded on each bag and the analysis was stated on the invoice ; and the sellers proposed, in order to assist retailers, to supply them with forms showing the analysis of their fertilizers, which could be passed on to customers. The Ministry explained that, if retailers furnished their customers with this form, it would still be necessary for the retailers either to mark each parcel with the full particulars of analysis or to mark a stack of parcels with a symbol, the meaning of which would have to be entered in a register. It was suggested, however, that the requirements of the Act, as regards both marking and giving the statutory statement, would be satisfied if the bag

containing the fertilizer were printed with the full particulars required, or if a label containing these particulars were attached to each bag or placed inside it.

The provision for using a mark, the meaning of which is entered in a register, in place of the full particulars, for the purpose of marking parcels, has been the subject of a number of inquiries. Several firms have asked whether it would be permissible for them to use the brand names of proprietary articles as "marks." The Ministry has generally replied to the effect that there seemed to be no objection, though in one case, where it was proposed to use the name "potato manure," it was pointed out that this might not be sufficiently distinctive for practical purposes, since it would probably happen at some time or other that another potato manure of different composition would be in store, and a name could not appear in the register as indicating two different sets of particulars.

Scope of the Act.—A lime company asked whether a statutory statement was required in respect of the sale of a mixture of ground lime and ground carbonate of lime which had been made up at the request of the purchaser. The Ministry drew attention to proviso (i) to Section 1 (1) of the Act, and pointed out that the effect of this proviso was to relieve sellers of the obligation of furnishing a statutory statement in the case of mixtures of articles which had been sold and subsequently mixed, at the purchaser's request, before delivery.

In another lime case, the Ministry was asked whether the Act applied to the sale of an impure carbonate of lime, known as "crag," either when ground or as quarried. The opinion expressed was that the Act does not apply to the sale of unground carbonate of lime, but that the question whether ground "crag," comes within its scope depends on whether this article is substantially limestone or chalk, notwithstanding that it contains some impurities. It was pointed out that this could, in the last resort, be determined only by a Court of Law.

A firm of maltsters selling malt culms to merchants inquired whether these sales came within the purview of the Act. The effect of the reply sent was that the Act applies to articles sold for use as food for cattle or poultry and that the question whether any particular sale of malt culms was for such purpose was one of fact, which only a Court of Law could decide. The Ministry expressed the opinion, however, that a

seller would not be able to escape liability merely by reason of the fact that he sold to a merchant for re-sale, and not directly to a farmer for his own use.

The question was asked whether it would be proper to sell biscuit meal containing dried meat without any guarantee, as this article did not appear by name in the First or the Second Schedule. It was pointed out that, if the biscuit meal contained any article mentioned in Part II of either the First or the Second Schedule, it appeared to fall within the description "Compound cakes or meals."

A local authority sought the Ministry's opinion as to whether particulars of analysis should be given on the sale of a well-known brand of poultry spice. The directions on the packet showed that it was intended to be used in extremely small doses and the Ministry took the view that it could not reasonably be regarded as "food" for poultry within the meaning of the Act. Another correspondent asked whether the Act applied to mineral mixtures generally, when used as condiments. The Ministry replied that, if these mineral mixtures were not a food for cattle or poultry and were not sold for use as such, they did not appear to come within the scope of the Act. Somewhat similarly, the reply to a question whether the sale of mowrah meal, for use as a worm destroyer, was affected by the Act was that, if the article was not sold as a fertilizer, the sale would not be subject to the Act.

In reply to an inquiry as to the application of the Act to dog foods, the Ministry drew attention to the definition of "cattle" in Section 26 (1) of the Act, and said that the sale of articles as dog foods did not come within its scope. The Ministry also expressed the opinion that pigeons are not included in the expression "poultry" for the purposes of the Act.

Opinions were expressed, in response to inquiries, that neither greaves nor raw hair waste comes within either the First or the Second Schedule to the Act, and that "chick feed" would be excluded if it consisted merely of whole or broken grains and did not contain any meal.

Milling Offals.—A firm of millers said that they proposed to mix with their wheat offals a proportion of imported sharps, plate pollards, oat offals, wheat screenings and tapioca, and to sell the mixture as "sharps," with a guarantee of the maximum amounts of oil, albuminoids and fibre, and a statement that the article contained Third Schedule ingredients. They asked whether this procedure would comply with the

National Mark Beef. Birmingham Competitive Shop Window Display. The Winning Display.

requirements of the Act. The Ministry replied that the description of such a mixture as "sharps" would constitute a contravention of the Act; that where Third Schedule ingredients were present in a feeding stuff, the names of these articles must be declared; and that the analytical particulars required in the case of compound cakes or meals are the actual amounts of oil, albuminoids and fibre, not the maximum amounts which may be present.

The Department was asked what particulars should be stated on the sale of a feeding meal composed of barley, wheat and oat husk. The applicant was informed that the article was apparently a "compound meal" and that, accordingly, the analytical particulars required in respect of compound meals should be given. It was added that, since the feeding stuff contained oat husk (a Third Schedule article), it would be necessary, also, to declare the presence of this ingredient.

General.—An inquiry was made as to whether a trader was in order in including in his sale note a clause to the effect that he gave no warranty as to the fitness for any particular purpose of feeding stuffs sold by him, or as to their freedom from injurious qualities. The Ministry invited the writer's attention to Section 2 of the Act and advised that a statement of this kind would not enable a trader to evade his legal obligations.

A suggestion was received to the effect that certain millers were defeating the objects of the Act by guaranteeing standard percentages of fibre in their offals, which were much in excess of the amounts actually found. The correspondent submitted that there was nothing in the Act to prevent a seller from "playing for safety" and guaranteeing a feeding stuff as containing, say, "oil, nil; albuminoids, nil; fibre, 100 per cent." The Ministry replied that a statement of analysis would not comply with the requirements of the Act unless it stated the actual percentages as far as could reasonably be ascertained, and expressed the view that, as a matter of law, proceedings could be instituted in respect of a gross overstatement of the fibre content of wheat offals, or in respect of a gross understatement of a valuable constituent in a fertilizer or feeding stuff.

A similar case was put by a sugar beet company which inquired whether it would be in order in guaranteeing the minimum amount of sugar and the maximum amount of fibre in beet pulp. The company suggested, as an alternative, that they might quote average figures. They were also told that, in order to meet the requirements of the Act, it would be necessary to state the actual percentages of sugar and fibre as nearly as could reasonably be ascertained.

A correspondent asked what limits of variation would operate in the case of a fertilizer which was not included in the Schedules, such as dissolved leather meal. The reply was to the effect that, since no limits of variation were prescribed for this article, sellers would be enabled to sell subject to their own limits, which could be fixed sufficiently wide to ensure that they covered the usual amounts of variation in the article.

A firm selling proprietary brands of feeding stuffs asked whether the Act required them to be sold under the names specified in the Fourth Schedule in respect of these articles, *e.g.*, "Feeding meat meal" or "Feeding meat and bone meal." The Ministry replied that no obligation was imposed upon sellers to sell fertilizers or feeding stuffs under the names defined in the Fourth Schedule, but that, if any article was sold under such a name, a warranty was implied that it accorded with the definition contained in that Schedule in respect of the article.

Several inquiries have been received as to who was responsible, in the first instance, for giving the warranty required by the Act in the case of sales of fertilizers and feeding stuffs "c.i.f. a port in this country." The Ministry has taken the view that, since the first seller of such goods would be someone abroad and, therefore, not subject to English law, the first person required to comply with the requirements of the Act in the case of goods delivered ex-ship or ex-quay was the person who first takes delivery in this country and who clears the goods through the Customs.

In reply to a question as to whether Inspectors could be required to pay for samples taken under Section 12 (1) of the Act, the Ministry expressed the opinion that the meaning of "take" in Section 12 (1) was "take without payment."

Many inquiries have, of course, been received as to the steps that should be taken to obtain an analysis of articles purchased. In all such cases, it is the practice to inform the applicant of the name and address of the analyst appointed by his local authority and to draw attention to the facilities which exist under the Act for drawing and analysing samples on behalf of purchasers.

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A CURIOUS CASE OF PHOSPHORUS POISONING IN SHEEP

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To the fact that sheep are seldom exposed to the risk of assimilating mineral poisons may be attributed the somewhat rare occurrence of this form of ovine poisoning. In America, sheep have been poisoned by ingesting the salts of lead, zinc, copper, silver and gold with which they come in contact when pastured on mountain ranges where a variety of mineral ores occur. In this country, occasional deaths have followed the use of arsenical sheep-dips. Poisoning by phosphorus is relatively frequent among the smaller domestic animals and, when it occurs, can usually be traced to the careless use of phosphorus paste in the destruction of vermin. Among sheep, however, this type of poisoning must be exceedingly rare as very few cases are recorded in veterinary literature.

Phosphorus Poisoning among Sheep on Artillery Ranges.—A curious case of phosphorus poisoning among sheep, occurring on a large hill farm situated high in the Coquet Valley, and forming part of the practice range used by the Royal Artillery at Redesdale Camp, was investigated last year. A certain number of deaths, which could not satisfactorily be accounted for either on the score of shrapnel injury or disease, had occurred on these ranges in previous years. In the absence of any close investigation such deaths were usually attributed to Braxy. During the week immediately preceding June 12, 1929, 20 ewes and lambs had been found dead, and the owner, aware that Braxy is almost entirely confined to young sheep, invited the writers to undertake an investigation. A visit was accordingly made on June 12, when eight dead ewes and lambs, brought down from the range, were submitted for inspection. Of these, five were autopsied. The post-mortem appearances, which are described below, showed some indication of the presence of an irritant poison. In conversation with the shepherds, it was elicited that, on June 4, a number of shells (presumed to be high explosive) had been fired on an area of the range known as Woolburst Law. During the following seven days, twelve ewes and lambs, which had been grazing this area, were found dead. On another part of the range, eight sheep died in the same period.

Symptoms.—A ewe was observed by the shepherd to be ill on Thursday, June 6, two days after shells had been fired on Woolburst Law. This animal showed great weakness and abnormal thirst. Towards evening, it was unable to rise and was found dead next morning. There was an opportunity, also, of observing the case of a lamb two months old which died after 48 hours' illness, and which afterwards proved to have been affected with phosphorus poisoning. There was abdominal pain and great weakness, the animal being unable to rise. Food and water were refused. No nervous symptoms were noted and jaundice was absent. The lamb's condition was one of extreme dullness, and death was preceded by coma.

Post-mortem Appearances.—All cases examined showed fatty degeneration of the liver. The mesentery and small intestines were jaundiced as the result of absorption of bile from the swollen liver. The large intestines were extensively inflamed and it was evident that the irritant effect of the poison had been confined mainly to these organs, the contents of which were scanty and streaked with blood. The mucous membranes of the fourth stomach and small intestines did not appear to have sustained any damage. The kidneys were soft and pulpy, but as the carcasses were not examined for several days after death and were then in a state of decomposition, it was difficult to dissociate these appearances from post-mortem changes.

On the afternoon of June 12, accompanied by Major Bett, R.A.V.C., the writers visited the Redesdale Artillery Camp for the purpose of obtaining accurate information concerning the explosives in use. It was ascertained that 60 shells had been fired on Woolburst Law on the occasion already referred to, and that these projectiles, instead of containing high explosive, as had been assumed, were smoke shells. The Handbook for Q.F. 4·5-inch Mark I and Mark II Howitzers (1927) states that this type of shell, which is technically described as "Shell Q.F. Smoke 4·5-inch Howitzer Mark VI," is of the container type, made of forged steel, and has a separate screwed-on head. The smoke charge, approximately 4½ lb. of phosphorus, and a burster of 9½ oz. of trotyl, is carried in the container which is fitted with an exploder. It immediately occurred to the writers that the observed symptoms and post-mortem appearances were not inconsistent with phosphorus poisoning. No instance of phosphorus poisoning among animals grazing on gun practice ranges appears to have been recorded, and

artillery officers with whom the matter was discussed had never experienced any cases.

Other lines of inquiry having been followed without success, it was decided to eliminate phosphorus poisoning or establish it as the cause of death by toxicological examination. On June 14 and 15, the appropriate tests for elementary phosphorus were therefore applied to the internal organs of four sheep which had been post-mortemed on the occasion of our visit. Positive results were obtained in every case.

Analytical Methods.—The viscera, together with contents of stomach and intestines, were finely mascerated, and an aliquot part subjected to Mitscherlich's process. Confirmatory evidence was obtained by the test of Blondlot and Dusart, which had been applied to a second portion of the visceral material. A modified form of the apparatus (devised by Blondlot and improved by Fresenius), which is described by Wynter Blyth,* was used for spectroscopic examination of the precipitate obtained.

These results, although hoped for, were hardly anticipated, as it was difficult to account for the presence of unexpended phosphorus on the ranges. To the uninitiated it would appear that the detonation of the burster would be followed immediately by ignition of the entire charge of phosphorus, which would undergo rapid conversion to its oxidation products. The actual "smoke" is said to be relatively innocuous; in any case inhalation by sheep would not account for the presence of elementary phosphorus in their internal organs. Incidentally, sheep on the Redesdale ranges do not come in contact with the smoke screen; it was observed that they leave the firing zone immediately the first shell bursts and return very soon after practice has ceased. This latter fact proved of considerable significance in the light of information afterwards obtained.

An inspection of the shelled area, carried out on June 19, only two hours after firing had ceased, revealed that all of the phosphorus is not ignited when the shell bursts. Numerous fragments of the element, some of them as large as a bean, were found scattered in the immediate vicinity of the shell holes. The detection of these pieces was easy by reason of the fumes which they emitted. In some cases phosphorus was found in the actual shell holes, the black tarry material with which they were splashed bursting into flames when stirred.

*Wynter Blyth, *Poisons: Their Effects and Detection.* (Griffin & Co.)

The persistence on the ground of so much elementary phosphorus, the early return of the sheep to the shelled area after firing had ceased and the absence of any other source from which the poison could have been derived, leave no doubt that phosphorus found in the carcasses was derived from smoke shells. It will have been noted that, after the ingestion of toxic doses of phosphorus, symptoms of illness in the sheep may be delayed for two or more days, and that the changes found on post-mortem examination were principally in the liver and large intestines.

It is difficult to believe that sheep unwittingly ingest fragments of phosphorus while grazing, and we can only suggest that this element may possess an attraction for sheep similar to that exerted by lead paint for cattle.

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THE CONTROL OF THE RED BUD BORER

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SERIOUS damage to buds top-worked on Morgan Sweet stocks by the larvæ of the Red Bud Borer (*Thomasiniana oculiperda*, Rübs.) at Long Ashton, during the season 1925-26, clearly indicated the need for experiments to devise some means for the control of the fly.

Fryer[1] records the numerous failures in newly-budded stocks of rose, apple and plum due to the pest, and describes the manner in which the larvæ of the fly penetrate beneath the bud or under the bark of the stock where the incision has been made. Fryer also traces the history of this pest so far as it is known. He quotes Sorauer as suggesting, as a preventive measure against this insect, that "the usual raffia fibre used to tie up the buds should be replaced by woollen thread which has previously been dipped in turpentine mixed with a little linseed oil and naphthalene, the threads being thoroughly dried before using." "Whether this method has actually been found successful in practice is not stated. It is evident that the complete protection of the wound made in the process of budding is the most certain method of preventing attack."

Barnes[2] describes the midge and the larvæ and gives a short account of the life history as follows :—

"The brick-red maggots live between the joints of junction of the two layers of cambium and, feeding on the sap, stop the growth of the graft, even when the latter has been partly welded to the stock. The midges appear from the middle of July to the middle of August and lay their eggs in the slits of the grafts. The female lays from six to twelve ova in each bud. On hatching, the larvæ attack the scion and thus cause separation of the stock and scion."

In addition to the above statement, Barnes records the larvæ of this fly as causing failures of shield grafts on peach, apricot and pear trees in July and August on the Continent, and quotes Karsch, who stated that whole rose nursery gardens were destroyed during September and October in 1887.

Experiments at Long Ashton, Season 1926.—Buds of the Kingston Black variety of apple, topworked on the Morgan Sweet variety, were treated in various ways as a preliminary experiment. In each case 18 buds were inserted* and tied with raffia in the usual way, and were thoroughly coated immediately after tying with (*a*) lead arsenate paste made up with water into a thin cream, (*b*) palm oil, (*c*) cocoanut oil, (*d*) cocoanut oil containing 1 per cent. phenol, (*e*) vaseline. Eighteen buds were tied but not treated, as a control. The budding and the treatments were carried out on August 11, 1926, and the examination of the buds was made on August 25, 1926. The results of the preliminary experiment described above are given in Table I.

TABLE I.—RESULTS FOR SEASON 1926

Treatment	No. of buds worked	No. of buds containing larvæ	No. of buds which failed to take
Lead arsenate	18	4	6
Palm oil	18	0	16
Cocoanut oil..	18	0	14
Cocoanut oil plus 1 per cent. phenol	18	0	18
Vaseline	18	0	4
Control (untreated)..	18	6	7

These results showed that while lead arsenate gave no appreciable control, palm oil, cocoanut oil (both pure and containing phenol) and vaseline gave complete control of the

* The technical work was carried out throughout both the experiments by the same person.

larvæ of the fly and prevented all of them from entering those buds so treated. With the exception of the lead arsenate and vaseline the treatments seriously damaged the buds. Accordingly it was decided to test vaseline on a larger scale during the following season, using newly-budded roses, which are usually considered more susceptible to attack by the larvæ of the fly than are apples.

Experiments at Long Ashton, Seasons 1927-28.—In this experiment, eight varieties of roses were used, 72 buds being treated with vaseline* and 72 being left untreated as controls. The budding was carried out on July 29, 1927, and the buds were examined for larvæ on August 17, 1927, and, for the "take" of the buds, on March 1, 1928. The results are here set out in Tables II and III.

RESULTS FOR SEASON 1927

TABLE II.—CONTROL ROWS (BUDS NOT TREATED)

Row	Variety	No. of trees	No. of buds with larvæ present	No. of "takes"	No. of failures
I	Betty Uprichard ..	9	0	8	1
	Ophelia	11	3	4	7
	Hugh Dickson ..	4	0	2	2
II	Los Angeles ..	19	1	11	8
	Hugh Dickson ..	5	0	4	1
III	Margaret D. Hamill	14	2	5	9

TABLE III.—ROWS IN WHICH BUDS WERE TREATED WITH VASELINE

Row	Variety	No. of trees	No. of buds with larvæ present	No. of "takes"	No. of failures
I	Red Letter Day ..	16	0	7	9
	Betty Uprichard ..	8	0	2	6
II	Frau Karl Druschki	19	0	14	5
	Los Angeles ..	5	0	3	2
III	Covent Garden ..	15	0	11 (plus 1 bud doubtful =12)	3
	Margaret D. Hamill	9	0	4	5

The above tables indicate that though the attack was light (only six buds affected in the controls) no case of attack was present in those buds coated with vaseline. This bears out the results obtained on apples during the season 1926.

The Effect of the Coating of Vaseline on the Buds.—Consideration of the three varieties of roses which occur among the

* It should be mentioned that, in all cases where buds were coated with vaseline, or other compounds, the coating was purposely carried out in a rough manner such as would be certain to occur in practice. No precautions were taken to prevent the vaseline from covering the bud.

vaseline treated rows, and in the control rows, suggests that the percentage take was increased by the use of vaseline in the case of the varieties Los Angeles and Margaret D. Hamill, but appeared to be adversely affected with the variety Betty Uprichard. If, however, this matter is considered without relation to the varieties concerned, there appears to be little to choose between treated and untreated buds. The figures for "takes" and failures are collected into Table IV.

TABLE IV

Treated with Vaseline			Control (untreated)		
Row	"Takes"	Failures	Row	"Takes"	Failures
1	9	15	1	14	10
2	17	7	2	15	9
3	15	8	3	13	11
Total	41	30	Total	42	30

One bud in the treated series was doubtful. If it be taken as a failure this will give one failure more in the vaseline series than in the untreated series, 72 buds being treated in each case. If this doubtful case is considered as a "take," the figures correspond exactly in the two series.

It may safely be assumed therefore that the coating of buds with vaseline, immediately after tying, does not lower the percentage "take," though it cannot be definitely looked upon as beneficial. It should be mentioned, however, that the callus formation was more profuse and more rapid in the case of the vaseline-treated buds of roses and apples in both the experiments described than in those which were untreated. The winter of 1927-28 was exceptionally wet, and conditions were conducive to failure of buds.

An examination will be made of the growth which the buds have produced by the end of the season in order to determine whether any beneficial results are apparent after that period.

Results for Season 1928.—The work carried out in the seasons 1926 and 1927 showed that there was no apparent reduction in the percentage "take" of freshly inserted buds, on apples or roses, by covering them with vaseline after they had been tied with raffia in the usual manner.

As a further check on these results, an additional experiment was carried out during the season 1928. A number of French crab stocks (150) were budded with the variety Bramley Seedling early in August, 1928. The work was carried out by the same individuals responsible for the budding experiments

already referred to in this paper. All the budding and the tying of the buds and their treatment with vaseline was carried through on the same day. The total number of buds inserted was 150, of which 75 were treated with vaseline after "tying," the remainder merely being tied. The results obtained were as follows :—

Percentage "take" of untreated buds .. .. 80 per cent.
Percentage "take" of buds treated with vaseline 96 per cent.

These results fully bear out those obtained during the previous two seasons.

Conclusions.—The experiments show that attacks of the Cecidomyid fly known as the Red Bud Borer (*Thomasiniana oculiperda*, Rübs.) may be prevented on the rose and the apple by coating the buds thoroughly, immediately after tying, with ordinary vaseline. The percentage "take" of buds is not affected adversely and, while it is not certain that this percentage is increased, callus formation is greatly stimulated.

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RESULTS OF SUGAR BEET VARIETY TRIALS IN ENGLAND

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DURING the three seasons 1927-29 the National Institute of Agricultural Botany carried out a series of trials with 11 strains of sugar beet. The strains were selected—in the light of previous experience—from lists supplied by leading Continental and English seedsmen, and were principally of the "E" and "N" types. Dippe E was taken as the control variety. Steps were taken to see that the seed used in the trials accurately represented commercial bulks.

Stations and Climatic Conditions.—The trials were laid down each year under the supervision of resident Crop Recorders at three of the Institute's sub-stations situated as follows :—

(1) The Norfolk Agricultural Station, near Norwich.
(2) The Harper Adams Agricultural College, Newport, Salop.
(3) Good Easter, near Chelmsford, Essex.

At Good Easter the soil was a strong boulder clay with clay sub-soil, and the annual rainfall was below the general average

of the east of England. The soils at the other two centres were moderately light and of open texture, while the rainfall was about equal to the average of the main arable districts of England.

The climatic conditions in the three seasons were markedly different. In 1927, a dry spring was succeeded by a comparatively sunless summer with rainfall considerably above the normal. It was a poor season for sugar beet in England. The rainfall in 1928 was rather below average, but both sunshine and mean temperatures were above the average, and it was a good year for the crop. In 1929, the rainfall was much below normal, especially in March and September. Sunshine and mean temperatures were above the normal. At Norwich the yield of roots was probably reduced through drought, but at the other stations the crop did not appear to suffer. It was an excellent season for sugar beet except where the crop was grown on very light soils.

General Observations.—The trials were cultivated in accordance with the best practice of each district. The plant populations were high and reasonably constant. Interference by diseases or insect pests was negligible, and in no instance was one strain more affected than the others. The trial method adopted involved the use of 10 plots of each variety, and gave results of a satisfactory standard of accuracy, the probable error being generally about 2 per cent.; in one case only did it exceed 3 per cent. The whole of the crops were washed before being weighed. The sugar contents were determined at Cambridge on representative samples drawn before lifting.

Varietal Differences in Growth.—Zapotil II and Schreiber S.S. produced very large tops. Janasz, Kuhn P and especially Marsters had small tops. The other strains produced tops which were medium-large to large in size.

Janasz was by far the worst bolter. Dippe E, Strube E, Gartons' 426 and Vilmorin B were also inclined to produce many bolters. The other strains were satisfactory in this respect, while Marsters was almost free from bolting.

Some strains were definitely more fanged and more difficult to lift than others, especially on clay soils. Dippe E, Strube E, and especially Janasz and Schreiber S.S. were the worse in these respects. The best were Kuhn P, Marsters, Vilmorin B and Kleinwanzleben E.

No marked difference in date of ripening was observable, though there were indications that Janasz, Marsters and Kuhn P were inclined to mature earlier than the rest.

Tabulated Results.—The principal results are given in Tables I to IV. The value per acre figures are based on the 1928-30 subsidy period price paid by factories. No deduction has been made on account of freight.

It is worthy of note that from the point of view both of agricultural production and of the cash return to the farmer the order of the strains is substantially the same, since the strains which yielded the most sugar per acre were also the most profitable. On the other hand, the strains with the highest sugar content were not so profitable, as their higher sugar was more than offset by their lower yields.

Review of Varieties.—*Kleinwanzleben E.*—In an average of all the trials this strain produced larger roots than any other and is bracketed with Dippe E in having a lower sugar content than the other strains. It gave the highest yield of roots, the greatest yield of sugar and the highest returns per acre of any variety, except at Good Easter, where it came below Dippe E in each of these respects. Its best performance was on the lighter and more friable soils at Norwich and Newport; it appears to be definitely the best variety to grow under similar conditions. It is a constant type in the character of its foliage, in the shape and weight of its roots, etc. The rather lower sugar content of its roots appears to be more than compensated for by its high yields. It has never bolted badly, and, as it is fairly free from fangs, it is not difficult to lift. It produces a satisfactory amount of top.

Dippe E.—This strain—used at each station as control—gave consistently high yields in all seasons. It is a typical E type, giving large roots with a relatively low sugar content. In average yield of sugar and value of roots per acre it was only exceeded by Kleinwanzleben E. On the heavy land at Good Easter it actually surpassed Kleinwanzleben E in both these respects, and may be the best strain for such conditions, though even there its advantages in yield and sugar are to some extent discounted by the greater difficulty of lifting it and its greater propensity to "bolt." It did not give relatively quite such good returns at the Shropshire centre and gave still lower values at Norwich. On the light land stations also it was inclined to produce a high proportion of bolters. It produced a large top and had rather more than the average number of fanged roots.

Strube E.—On an average this strain gave good returns, but was less constant than Kleinwanzleben E or Dippe E. It

yielded less than these strains at each centre, but its rather higher sugar content brought its sugar yield up to the level of Dippe E at both Norwich and Newport. Its returns at these centres were relatively better than at Good Easter, and it appears to be most suitable for lighter soils. In spite of its name, this is of the N type. It produced a large top and had more than the average number of fanged roots. It gave more than an average number of bolters.

Hoerning H.S.—This belongs to the same type as Dippe E and Kleinwanzleben E, giving high yields of roots of rather low sugar content. It gave better results than Dippe E at Norwich, but was poorer elsewhere. In its returns per acre it came second to Kleinwanzleben E at Norwich, and appears to be a suitable type for such conditions, though less adapted for the conditions prevailing at the other centres. Its roots were fairly free from fangs and easy to lift. It produced a large top and less than the average number of bolters.

Zapotil II.—This strain was, on an average, either fourth or fifth in its returns per acre at each station, and does not appear to merit any special attention. It produced a very large top, but only an average number of bolters. It was moderately free from fangs.

Gartons' 426.—On average results this strain gave no better returns than Zapotil II, though—like Dippe E—it gave relatively better results at Good Easter. It produced large tops and more than an average number of bolters. Its roots were fairly free from fangs.

Schreiber S.S. and Vilmorin B.—These had no outstanding merits. In root yields, sugar yields and value of sugar per acre they were always definitely inferior to Dippe E. Schreiber S.S. produced very large tops but it did not bolt badly. Its roots were more fanged than the other strains, and it was difficult to lift on clay soils. Vilmorin B produced tops of medium size and above the average number of bolters. Its roots were fairly free from fangs and easy to lift.

Kuhn P.—This gave definitely lower returns than Dippe E, except at Norwich, and, in 1927, in Shropshire, but in these cases it was surpassed or equalled in value by both Kleinwanzleben E and Hoerning H.S. On the heavy land at Good Easter its returns were relatively poorer still. It produces a small prostrate top and very few bolters. Its roots are of constant shape, free from fangs and easy to lift.

Marsters.—This invariably produced roots having a high sugar content, but in spite of this advantage, its average

TABLE I

AVERAGE RESULTS OF SUGAR BEET TRIALS AT NORWICH, SEASONS 1927-29

The strains are arranged in the order of their value per acre.

Strain	Weight of washed beets	"Bolters"	Sugar content	Yield of sugar per acre	Value of roots per acre
	Tons per acre	Per cent.	Per cent.	Tons	£ s. d.
KleinwanzlebenE	11.98	3·90	17·7	2·12	31 14 11
Hoerning H.S. ..	11·68	4·31	17·8	2·07	31 2 11
Kuhn P.	11·05	1·93	18·3	2·02	30 7 9
Strube E ..	10·75	9·06	18·5	1·99	29 18 5
Zapotil II ..	10·78	5·71	18·4	1·99	29 16 6
Dippe E ..	11·26	7·94	17·4	1·97	29 5 6
Gartons' 426 ..	10·50	6·79	18·1	1·91	28 10 6
Vilmorin B ..	10·71	6·71	17·7	1·90	28 7 8
Schreiber S.S. ..	10·41	3·55	17·9	1·87	27 18 8
Marsters ..	9·86	0·23	18·7	1·85	27 15 5
Janasz	9·14	13·42	19·4	1·78	26 16 3
Average of all strains ..	10·74	5·78	18·17	1·95	£29 4 11

TABLE II

AVERAGE RESULTS OF SUGAR BEET TRIALS AT NEWPORT, SALOP,* SEASONS 1927-29

The strains are arranged in the order of their value per acre.

Strain	Weight of washed beets	"Bolters" †	Sugar content	Yield of sugar per acre	Value of roots per acre
	Tons Per acre	Per cent.	Per cent.	Tons	£ s. d.
KleinwanzlebenE	14·62	2·00	16·7	2·45	36 6 2
Dippe E ..	14·28	5·22	16·6	2·37	35 4 6
Strube E ..	13·28	4·86	17·5	2·34	34 15 0
Gartons' 426 ..	13·18	5·94	17·5	2·31	34 9 9
Zapotil II ..	12·97	3·10	17·6	2·29	34 3 1
Marsters ..	12·51	0·18	17·9	2·25	33 11 4
Schreiber S.S. ..	12·91	2·81	17·4	2·26	33 11 4
Hoerning H.S. ..	13·20	2·60	16·9	2·24	33 4 5
Kuhn P.	12·76	0·90	17·2	2·21	32 15 0
Vilmorin B ..	13·00	4·89	16·7	2·18	32 5 8
Janasz	10·86	8·97	18·4	2·01	30 0 11
Average of all strains ..	13·05	3·77	17·31	2·26	33 13 5

* At Leegomery, near Newport, in 1927. † Average of 1928 and 1929.

TABLE III

AVERAGE RESULTS OF SUGAR BEET TRIALS AT GOOD EASTER, ESSEX, SEASONS 1928-29*

The strains are arranged in the order of their value per acre.

Strain	Weight of washed beets	"Bolters"	Sugar content	Yield of sugar per acre	Value of roots per acre		
	Tons Per acre	Per cent.	Per cent.	Tons	£	s.	d.
Dippe E ..	12·91	3·59	18·1	2·34	35	1	6
Gartons' 426 ..	11·74	3·04	18·8	2·21	33	5	3
KleinwanzlebenE	12·39	1·05	17·8	2·21	33	0	10
Zapotil II ..	11·40	1·87	18·6	2·13	31	18	5
Strube E ..	11·28	2·70	18·5	2·09	31	7	11
Vilmorin B ..	11·40	3·57	18·3	2·08	31	7	0
Hoerning H.S. ..	11·60	1·49	17·9	2·08	31	2	7
Schreiber S.S. ..	11·07	1·64	18·4	2·03	30	12	6
Kuhn P.. ..	10·53	0·53	18·8	1·99	29	16	8
Marsters ..	10·35	0·24	19·0	1·97	29	13	4
Janasz	9·47	5·38	19·4	1·84	27	15	7
Average of all strains ..	11·29	2·28	18·51	2·09	31	7	5

* The 1927 results at Good Easter were less reliable owing to an imperfect "plant" and have been altogether excluded from these tables.

TABLE IV

GENERAL AVERAGE RESULTS OF SUGAR BEET TRIALS AT NORWICH, NEWPORT AND GOOD EASTER IN 1927-29

The strains are arranged in the order of their average value per acre.

Strain	Average Weight of washed beets	"Bolters"	Average Sugar content	Average Yield of sugar per acre	Average Value of roots per acre		
	Tons Per acre	Per cent.	Per cent.	Tons	£	s.	d.
KleinwanzlebenE	13·07	2·32	17·3	2·26	33	15	3
Dippe E ..	12·81	5·58	17·3	3·23	33	1	10
Strube E ..	11·83	5·54	18·1	2·14	32	2	9
Hoerning H.S. ..	12·23	2·80	17·5	2·13	32	0	0
Zapotil II ..	11·76	3·56	18·1	2·14	31	18	11
Gartons' 426 ..	11·82	5·26	18·0	2·14	31	18	3
Kuhn P.. ..	11·56	1·12	18·0	2·07	31	4	3
Schreiber S.S. ..	11·51	2·67	17·8	2·05	30	13	10
Marsters ..	10·98	0·22	18·5	2·02	30	11	2
Vilmorin B ..	11·74	5·06	17·4	2·05	30	10	6
Janasz	9·87	9·26	19·0	1·88	28	5	11

returns per acre were lower than all strains excepting Janasz and Vilmorin B. At Norwich and Good Easter it was superior only to Janasz. It gave rather better returns in Shropshire, but was there also definitely inferior to Kleinwanzleben E and Dippe E. It produced a very small prostrate top, and was almost free from bolters. Its roots were of good shape, free from fangs and easy to lift.

Janasz.—This proved to be the least suitable and least profitable strain for English conditions. Its roots are small—badly fanged and difficult to lift on clay soils. It bolted very badly indeed.

Conclusions.—Several of these strains are worth growing in England, but the results of the trials suggest that on farms where the conditions resemble those at any of these three stations the preference should be generally given to Kleinwanzleben E, which has not only proved to be the most profitable at two stations but also has a good-sized top, is easy to lift and is not prone to bolt. Dippe E on the Essex clay also merits consideration.

Marsters and Kuhn P, both of which—especially Marsters—are small-topped and non-bolting strains, appear to be very suitable for growing on rich black land or deep silts where leaf development is encouraged to such an extent that lifting operations are difficult when big-topped strains are grown. Whether they would be more profitable to grow than large-topped strains under such conditions can be ascertained only from reliable trials. On account of their non-bolting habit they may certainly be recommended for very early sowing.

Those who would like further particulars about these trials may obtain a copy of the full report on application to the Secretary of the National Institute of Agricultural Botany, Huntingdon Road, Cambridge.

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APRIL ON THE FARM

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THE longer days and rising temperature are a powerful stimulus to plants and animals, but the progress of vegetation will vary with latitude, elevation and soil. A later start into growth is normal in north latitudes in this country and at high elevations; on heavy soils and, especially, on badly drained soils, growth is also later. The leafing of trees is of interest and the influence of local conditions may be noted as well as comparisons made between one year and another. Cultivated crops and grass will be influenced by the same factors as the trees, but cultural treatment can do much to modify the influence of soil and situation, and a look round at this season of the year will indicate where the cultivator is stimulating the natural conditions with most success.

April weather is usually characterized by sudden and frequent changes, warm days and cold days, and some of the warmest days may be followed by the coldest nights, but changes of sunshine and showers are a welcome feature. Keen easterly winds often occur and are very disconcerting to the farmer by delaying growth, drying up moisture, and often leaving cereal crops at the mercy of wireworm and other grub attacks.

Live Stock.—Cattle which have been wintered out will begin to make good progress this month, especially where they can be changed to fresh pastures. The ideal fresh pasture is one that has been free of stock for some months and is in good manurial condition, or has been stimulated by the application of a dressing of complete fertilizers. An application of a quick-acting form of nitrogen early in March has much to commend it where early grass is desired, and such grass is always most acceptable to outwintered cattle and to sheep, especially ewes and lambs. The advantage is two-fold, by providing a longer full-grass period for stock and by allowing the change over of the stock from the hard bitten and hard trod winter grazings in time to permit of these pastures recovering before they become baked and dry.

Cattle which have been wintered in stalls or yards cannot be turned out freely in uncertain weather and should be gradually hardened off. Cool and well-ventilated winter accommodation will make it easier to get the stock early

out of doors without undue danger of chills or other drawbacks. When stock are to be turned out permanently without gradual hardening off, it is advisable to wait until the weather is fairly reliable. Milk cows which have been indoors for the greater part of the winter should have a gradually extended period out of doors each day, and the stalls should be kept as cool as possible at night.

Grass in April must have a good start before it is heavily stocked, as it should be realized that growth is usually not so strong as during May; the early growth is not difficult to keep under control and its stock-carrying capacity can easily be overestimated, resulting in a shortage of grass feed before the normal summer growth is available. The time of stocking a pasture and the degree of close grazing are important features of pasture management; it is usual for advocates of the intensive manuring and rotational grazing system to stress the need for periodical close grazing, and there is no doubt that the subsequent growth, being all young, will be of a highly nutritive and palatable character, but very close grazing is not conducive to a quick start in subsequent growth, especially on soils of a dry nature or in dry periods.

The summer of 1929 was much too dry in the south of England to give a good yield of grass from land which was closely grazed in the early part of the year, although there were notable differences due to the variation in the water-holding capacity of individual soils. Few will dispute the advantage of the "early bite," but it will be the exception rather than the rule for milk cows to be fully maintained on grass during April; water meadows, young pastures in good condition, and old pastures stimulated by nitrogenous manures will provide the exceptions. In the majority of cases, winter feeding may continue for the greater portion of the month and, in such an event, the shortage of hay will be a difficulty. Fortunately the fall in prices will justify the use of concentrates at the expense of hay.

Arable Land.—The sowing of cereals should be completed as early as possible in April; late sown crops are uncertain and often give rather poor returns. Oats are liable to be attacked by frit fly; barley is better suited for the later sowings. It is often preferable to substitute some crop, other than cereals, for late sheep-fed land, and many good crops of sugar beet have been obtained where an indifferent crop of cereals would have been almost certain.

The seeding of the land with clovers and grass seeds should be done this month. Some prefer to delay the sowing of the small seeds until the cereal crop has made a start and so avoid too profuse a growth of grass and clovers which might create trouble in a wet harvest. Such a desire is easily understood but the importance of the grass or clover ley in rotation farming is such as to justify the young seeds being sown under the best possible conditions. A firm and fine seed bed, the whole lightly harrowed in and rolled before the cereal has become advanced in growth, will do much to ensure the success of the seeds.

Seeds for permanent grass should have a special chance of success, as any adverse circumstances may materially reduce the productivity of the land for years. The mixture of seeds for permanent pasture will vary with local conditions, and local advice should be sought, but whatever the mixture, and whether of a simple or complex nature, the actual strain of the plants will be an important factor, and leafy strains should be obtained where possible.

For seeds of any kind, the land should be well supplied with phosphates and potash, and the application of manures containing these substances will do most good if applied at or about the time of sowing the seeds. Any effect these may have on the nurse crop will be towards better standing power, and consequently a better chance for the clovers and grasses.

Lucerne can be sown towards the end of the month; this is a crop which deserves much more attention, and its place as a long term ley in arable cultivation is well worth while. Well-drained soils are necessary and, where the plant has not been grown successfully, the seed should be inoculated with the special culture which ensures the presence of the necessary bacteria and the development of the nodules on the roots. The writer has had considerable success with broadcasting 25 lb. of lucerne seed per acre, using a cover crop of oats, sown at the rate of 3 bushels per acre, and cutting the whole crop as green forage about the middle of July. The land must be free from weeds and a dressing of farmyard manure has been found very beneficial, this being ploughed under; in addition 5 cwt. basic slag and 1 cwt. sulphate of potash per acre are worked into the surface at seeding time.

The preparation of ground for root crops is an important part of the work during this month, and in many cases seed is sown. Sugar beet will be grown on an increased area and, for this crop, deep cultivations should have been done

earlier in the winter, the final cultivations being directed towards obtaining a good tilth. The time of sowing has an important bearing on the yield of the crop. Early sowing is often accompanied by a greater proportion of "bolters," but it is often necessary to distribute the sowing period over three or four weeks to facilitate the work of hoeing and thinning and in such cases it is better to start early than to finish late. The early sown crops, even with the "bolters," are often the most remunerative.

The area devoted to mangolds has decreased in recent years, whether by reason of certain things said about the root as a food for milk production, or on account of the cost of growing the crop, is not clear. Suitable land devoted to mangold growing will produce more animal food per acre than under most farm crops, and the roots are a healthy and useful food for most farm stock. The cost of producing mangolds is often exaggerated; their true cost is the amount by which the expenditure on the farm is increased and the income diminished, if any, as compared with the expenditure and income which would have accrued in respect of the crop which the mangold crop displaces. A limited area well done will be more profitable than an extended area indifferently cultivated. Another crop which can be drilled this month is marrow-stem kale and such early sowings will provide well-grown plants from September onwards; later sowings can be made for late use. Its manurial requirements are similar to those of the mangold crop, but it is a plant more sensitive to shortage of lime, and a more liberal supply of phosphate, especially soluble phosphate, is desirable to promote quick early growth, for the plant, especially if sown late, is apt to be attacked by the "Fly." Those who have not tried this crop should plant a small area if they require a good forage crop in late autumn and early winter.

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NOTES ON MANURES

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Manuring of Potatoes.—The past season has been a disappointing one for potato growers on account of the abnormally low prices which are still prevailing. This situation will no doubt tend to reduce the acreage for the coming year, but the position of the potato crop in our farming will probably not as yet be seriously affected. We may take the view that if the crop is to be grown at all it is best to aim at a good one within economic limits. It is the purpose of these notes, therefore, to bring out the broad results of manurial experiments on potatoes carried out at Rothamsted for the past eight seasons. In discussing the results, the conditions on the experimental farm should not be lost sight of. The soil is a clay loam with flints, at about 400 ft. elevation and is, therefore, rather late in character. It is not a soil on which great potash responses would be expected, but considerable increases in yield have followed the use of potash under certain conditions. The water relationships of the soil are good.

The Effect of Dung.—On most soils, farmyard manure is the standby of potato growers. It provides a considerable amount of potash and nitrogen, and what is probably more important, it produces those good physical qualities in the soil which improve the water supply and thereby assist in the utilization of plant food. The need of dung on peaty soils and on heavy loams with good moisture relationships is less than on the lighter mineral soils.

At Rothamsted, the effect of farmyard manure has been ascertained both alone and in combination with artificial fertilizers. The general results only are presented here, although seasonal effects were revealed from year to year.

It will be seen that the effect of dung, as measured by the crop increase, is about the same whether dung is used alone or in presence of sulphate of ammonia and superphosphate; the extra artificials applied in the absence of dung in no sense compensate for the lack of dung. When complete artificials are used, the case is different, probably due to the provision of potash in the mixture, and the difference between dunged and undunged plots is much smaller. It appears that, on soil of the Rothamsted type, potatoes may be grown successfully without dung provided that the artificials and,

AVERAGE YIELDS. TONS PER ACRE

Years	No. of plots	With dung	No dung	Difference	Artificials used as basal dressing
1921, '23 and '24 ..	10	7·10	4·87	2·23	None
1921-24 ..	13	7·95	4·94	3·01	N. and P. (No Potash)
1921, '23 and '24 ..	10	8·12	5·76	2·36	,,
1921-24 ..	86	8·26	7·59	0·67	Complete (N. P. K.)
1921, '23 and '24 ..	64	8·27	7·76	0·51	,,

Note.—Dung at 15 tons per acre (12 tons in 1921). Artificials with dung: 4 cwt. superphosphate, 1½ cwt. each of sulphate of ammonia and sulphate of potash. Without dung: 6 cwt., 2 cwt. and 2 cwt., respectively.

in particular, the nitrogen and potash are increased. One must not overlook, in this connexion, the value of dung in its residual effects and in maintaining the land in a good state of cultivation.

Increasing Dressings.—In 1924, an experiment was carried out to show the effect of increasing applications of a standard mixture consisting of 3 parts superphosphate, 1 part sulphate of ammonia, and 1⅓ parts sulphate of potash costing, approximately, 7s. per cwt. The results show the usual falling off in effectiveness as the rate of application is increased, although a return from the 10 cwt. dressing would be obtained unless potatoes fell below 26s. (neglecting the cost of handling the extra crop).

Quantity of artificials	Yield of potatoes	Successive Increases: Yields	Successive Increases: Cost of manure	Increase per 1 cwt. artificials
cwt.	tons	cwt.	s.	cwt.
0	6·61	—	—	—
5	7·80	24	35	4·8
10	9·33	31	35	3·1
20	10·57	25	70	1·2

Effect of Quantity of Nitrogen.—In the years 1923 and 1924 increasing quantities of sulphate of ammonia were used in presence of an adequate dressing of phosphate and potash. Dung was used in 1923 but not in 1924. The nitrogen was applied with the seed on some plots and additional sulphate of ammonia was top-dressed in certain cases. Taking the two years together the results were :—

INCREASE OVER NO NITROGEN : CWT. PER ACRE

Sulphate of ammonia in the seed bed	No top dressing	Top-dressed with 1½ cwt. sulphate of ammonia
1½ cwt.	32	44
3 cwt.	45	47

Average yield without nitrogen 10·0 tons.

It will be seen that 3 cwt. of sulphate of ammonia did better than 1½ cwt., but that no benefit was secured by dividing the 3 cwt. dressing. The highest dressing of sulphate of ammonia (4½ cwt. divided) on the whole was not appreciably better than the lighter dressing with the seed.

Kind of Potash.—It is well known that the potato is responsive to potash manuring. Not only does the crop absorb large quantities of potash from the soil, but it is grown on the lighter soils, which are, as a rule, not particularly rich in this constituent. Even on the heavy loam at Rothamsted, good increases are usually obtained from potash fertilizers, especially if no dung is used, but the effect varies considerably from season to season. The yields with the various potash manures are rather similar, but the smaller effect of the low-grade potash salts observed in various years, *e.g.*, 1927, is outside the experimental error. Quality determinations usually gives the preference to potatoes grown with sulphate, muriate coming a close second, with low-grade potash salts distinctly inferior.

Year	Yields with no potash Tons per acre		Increases due to potash, cwt.						Potash (K_2O) applied lb. per acre	
			Dung			No dung				
	Dung	No dung	Sulphate	Muriate	Low grade salts	Sulphate	Muriate	Low grade salts	Dung	No dung
1921..	3·48	1·35	9	1	0	48	55	44	80	108
	—	1·01	—	—	—	29	—	30	—	111
1922..	8·03	2·48	30	24	29	116	117	105	89	117
1923..	11·73	9·37	15	27	−2	50	45	34	85	114
1924..	7·85	6·20	−7	−9	1	22	19	32	92	122
1925..	—	5·03	—	—	—	83	88	87	—	108
1926..	9·45	—	38	41	30	—	—	—	108	—
1927..	6·92	—	9	5	−1	—	—	—	108	—
	6·92	—	9	2	−9	—	—	—	216	—

In the above table, the higher response in the absence of dung is very clear. With dung, the increase following the potash dressings has been good in 1922, 1923 and 1926, small

in 1927, and in 1924 there was probably a slight depression. With dung, the low-grade salts appear to have done distinctly worse than the sulphate or muriate.

Magnesium Effects.—In a few of the years, the effects of magnesium sulphate, or of potash salts containing it, were measured. The increases due to the addition of magnesium sulphate to various potash manures were negligible in 1921 and 1922.

Only in 1924 did there appear to be any suggestion of a good effect, which amounted in the aggregate to an increase of about 9 cwt. of potatoes. At several other centres in 1922, magnesium sulphate gave better results, the increases ranging from 8 to 18 per cent. with no dung, and 14 to 29 per cent. with dung. In view of the popularity of sulphate of potash-magnesia in certain districts on the Continent this effect deserves further study.

Effect of Phosphate.—In the potato experiments above described, the superphosphate occurred in the basal dressing and its individual effect, therefore, was not ascertained. Recently, interest has been aroused in the effect of phosphate on potatoes and, in particular, the effect of varying proportions of superphosphate in potato mixtures. In 1928, the effect of superphosphate at the rate of 3 cwt. per acre was ascertained in conjunction with a balance experiment in nitrogen and potash. The results were :—

INCREASE FOR 3 CWT. OF SUPERPHOSPHATE : CWT. PER ACRE

Mean of all 9 treatments, 0·48 cwt.
" 5 treatments either low or ill-balanced in respect of N and K, 0·33 cwt.
" 4 treatments better balanced and with normal or generous N and K, 0·68 cwt.

The effect of superphosphate in this experiment was significant, and, as might be expected, there is an indication that its action is more pronounced when the manuring with the other nutrients is ample.

The effect of increasing doses of phosphate has been examined on the sandy soil at Woburn. The yields were :—

	Cwt. of superphosphate				
	0	3	6	9	Basal dressing
1927 tons	4·06	4·10	3·96	4·08	Dung only
1928 "	12·25	13·43	14·00	14·69	Dung, 1½ cwt. each of sulphates of ammonia and potash.

In the first season there was no effect, but in the second there was a definite increase for each application of superphosphate, possibly due to the better growing conditions and more generous basal dressing.

Balance of Manures.—More recently, attention has turned to the interaction of one fertilizer on another. An interaction occurs when two manures, used together, give more (or less) than the sum of the increases which the two manures produce separately. In the former case, the manures may be said to help each other out. In the four years, 1925-28, experiments in this point have been conducted with sulphate of ammonia and sulphate of potash. It is not possible to set out the data in detail, although the response to nitrogen and to potash differed quite markedly from season to season. Nevertheless, by taking all the years together, a general view of the behaviour of these two fertilizers is obtained.

YIELD INCREASE: CWT. PER ACRE, 1925-28

		Sulphate of potash: cwt. per acre		
		0	2	4
Sulphate of ammonia: cwt. per acre	0	0 (0)	15 (21)	16 (39)
	2	20 (13)	49 (12)	55 (16)
	4	24 (21)	71 (12)	75 (15)

Yield with basal manuring 6·62 tons.

Note.—Dung was used in all cases except 1925. A basal dressing of superphosphate was also applied. In 1928 the manures were each used at 1½ and 3 cwt. per acre. The figures in brackets give the approximate cost in pence of an extra 1 cwt. of potatoes calculated from the cost of the corresponding nitrogen and potash dressings.

It will be noticed that in every case the joint effect of potash and nitrogen exceeds the sum of their individual effects. On the whole the action of nitrogen has been rather greater than that of potash, *i.e.*, practically as good a result has been produced with 2 cwt. of sulphate of potash as with 4 cwt. when ample nitrogen is provided. This is no doubt due to the fact that dung was used and the soil is of rather heavy type. On ligher soils, and in the absence of farmyard manure, the higher dressings of potash might be more suitable. All the dressings have produced increased yields of potatoes at a low cost for manures, but, as might be expected the more balanced dressings have been more economica than the one-sided treatments. Further, the experiments show that under conditions where good crops are possible 1 cwt. each of sulphate of ammonia and sulphate of potash a scale of dressing which until recently was very generally adopted, is insufficient even where dung is given.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended March 12. Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) .. *	10 2*d*	10 2*d*	10 2*d*	10 2*d*	13 0
Nitro-chalk (N. 15½%) .. *	9 19*d*	9 19*d*	9 19*d*	9 19*d*	12 10
Sulphate of ammonia:— Neutral (N. 20·6%) .. .. *	10 2*d*	10 2*d*	10 2*d*	10 2*d*	9 10
Calcium cyanamide (N. 20·6%) *	9 6*e*	9 6*e*	9 6*e*	9 6*e*	9 0
Kainit (Pot. 14%)	3 6	2 19	2 19	3 3	4 6
Potash salts (Pot. 30%) ..	5 3	4 18	5 0	4 19	3 4
" (Pot. 20%) ..	3 15	3 9	3 8	3 11	3 7
Muriate of potash (Pot. 50%)	9 17	9 3	9 2	9 5	3 8
Sulphate,, " (Pot. 48%)	11 19	11 6	11 5	11 5	4 8
Basic Slag (P.A. 15¾%)‖ ..	2 13*c*	2 3*c*	..	2 9*c*	3 1
" (P.A. 14%)‖ ..	2 7*c*	1 16*c*	1 16*c*	2 3*c*	3 2
" (P.A. 11%)‖ ..	..	1 9*c*	1 9*c*	..	..
Ground rock phosphate (P.A. 26-27½%)‖	2 2*a*	2 10*a*	2 5*a*	2 2*a*	1 7
§ Superphosphate (S.P.A.16%)..	3 11	..	3 9	3 6	4 2
" (S.P.A.13¾%)..	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3¾%, P.A.20½%)	8 15	8 10	8 12	7 15	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%)	5 17*b*	..	6 10	4 15	..
Burnt Lump Lime	1 8*k*	1 10*l*	1 11*n*	2 2*m*	..
Ground Lime	1 12*k*	..	..	1 17*m*	..
" Limestone	1 3*k*	..	1 8*n*	2 6*m*	..
" Chalk	..	1 6	..	1 11*m*	..
Slaked Lime	..	..	2 12*n*	3 2*m*	..

Abbreviations: N.=Nitrogen; P.A.=Phosphoric Acid; S.P.A.=Soluble Phosphoric Acid; Pot.=Potash.

* Prices are for not less than 6 ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 80% through standard sieve. *a* Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

k 6-ton lots f.o.r. Bristol: ground limestone 98.95% through standard sieve.

l F.o.r. Knottingley.

m 6-ton lots delivered London district, ground limestone 65% through standard sieve. Ground limestone, ground chalk and slaked lime in non-returnable bags.

n 6-ton lots delivered Liverpool stations, ground limestone 45% through standard sieve. Ground limestone and slaked lime in non-returnable bags.

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NOTES ON FEEDING STUFFS

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Factors Affecting Efficiency in Digestion.—Last month's notes were devoted to a comparison of the digestive tracts of the various farm animals, and the most salient differences that were pointed out were concerned with the arrangements for dealing with fibre. Cattle and sheep, it will be remembered, have a complicated stomach of four compartments whose special function it is to enable them to cope with fibre; the horse has one huge compartment further down the tract for the same purpose; but the pig has nothing of the kind and is, therefore, incapable of dealing with coarse fodders. The distinguishing feature of herbivorous animals is that they can digest fibre well. This type of food stuff is a carbohydrate, and in the young plant (when it is pure cellulose) it has a nutritive value equal to that of starch, as has been shown by digestibility and feeding trials. There is no special digestive ferment produced in the animal body which effects the breaking down of fibre to assimilable form, but this function is performed by bacteria. A certain wastage occurs, as some of it is converted into gases which are lost from the body, but, as Dr. Woodman has shown recently, the majority of it gets broken right down to sugars, in which form it is absorbed and used.

The digestion of fibre is not only important for its own sake; the fibre forms the framework of the plant and the other nutrients are enclosed in it, so that until it is broken down it is very difficult for the digestive juices to penetrate to the nutrients inside and render them assimilable. It may be that the horse is not so efficient in digestion as the ruminating animals, because cellulose breakdown occurs relatively late in the tract, whilst in cattle and sheep it occurs at the outset, freeing the enclosed starch, etc., for the action of the ferments. As the plant gets older its framework ceases to consist entirely of cellulose, but a carbonaceous compound called lignin is laid down in it. Lignified fibre is digested only with great difficulty—it will all go to form heat in the body, and so can be used for maintenance, but not for production—and this is one of the chief reasons why plants have a greater food value in the young state.

The modern tendency is all for speed, and this is especially desirable in the digestive processes, for our animals have been carefully bred for generations to be efficient and economical

in converting large quantities of energy from an unsuitable to a suitable form for human consumption. If they are to produce much milk or to fatten very quickly they must consume and digest large quantities of food, and, since the amount they can hold at any one time is ultimately limited by the size of their digestive organs, those organs must be big (cf. the attention paid to the size of the "barrel" in breeding cows), and the ration must contain much nutriment in a small space. The latter requirement is achieved to a large extent, and it is well known that high production demands the use of concentrated food, but even with much of this it is difficult to get an economical and suitable ration containing enough starch equivalent and yet within the animal's capacity. One way of increasing capacity would appear to lie in keeping the animal well filled for as great a part of the day as possible, by feeding "little and often," and this has been strongly recommended in recent years. Another way of increasing consumption is by speeding up the rate of passage of the food through the animal, and some foods have an especial value because they are helpful in this direction. Succulent food has been shown to pass more quickly through the first two stomachs of the ruminant than dry foods, and to ferment more quickly; laxative foods are particularly useful in the case of high-yielding cows, which should always be kept in a moderately loose condition. The speeding up of the rate of passage of the food, like everything else, can be overdone, for if it is too quick the absorption of the nutrients from the food mass will be incomplete. Bulky food is, in general, slow in passing through the body, so that it is a good practice to feed it at night, when it will pass slowly on without hindering the digestion of quicker, more concentrated foods. Succulent food, it will be realized, can only be regarded as bulky if the starch equivalent *of its dry matter* is low, which is not usually the case, for its apparent bulk consists of water and the dry foods will take this up immediately on arrival in the stomach, to the varying extent discussed in these Notes for February. Indeed, it may well be that the fact that succulent foods are already "saturated" with water, with the consequent effect on the chemical form of their nutrients, explains their relative rapidity of digestion, which was pointed out above.

Grains are often fed in a crushed state and this is a good way of speeding up digestion, for it makes it possible for the digestive fluids to get at the starch inside at once. If

they are fed whole to cattle, a considerable proportion escapes the action of the teeth and of these fluids altogether, and passes out of the body without being attacked at all, and pigs can sometimes be "fed after cattle" for this reason. The following proportions of the total were found to be passed through the body completely unchanged (some of them would even grow subsequently) when whole corn was fed :—

	Cows	*Heifers*	*Calves*
Maize	22·8 per cent.	10·8 per cent.	6·3 per cent.
Oats	12·1 "	5·5 "	3·0 "

Thorough grinding, on the other hand, is not advisable, especially with foods like beans which give a very heavy meal; if that is done the meal forms a stiff, sticky paste in the stomach, into which the juices will not penetrate, and this may cause indigestion, and will certainly slow down the rate of digestion. Such foods are best fed in the crushed, kibbled, or flaked condition, or, at most, only very coarsely ground. Some foods owe much of their merit to the fact that they render the food mass in the stomach light and porous; for this a certain amount of fibre is necessary, and excellent foods for the purpose are oats, bran, and sugar beet pulp, whilst the use of chaff may find a justification in some cases from this point of view. In Denmark many farmers sow a mixture of oats and barley (in the proportion of 2 to 1) and grind up the mixed grain, the fibre in the oats having the effect of lightening up the meal. With horses, in which there is less churning movement of the stomach than in cattle, the avoidance of heavy meals is particularly important. Oats —a light food—are the most popular cereals for horses, and maize, if fed, should invariably be flaked rather than ground. In the days when horse omnibuses were run on the streets of Paris, trials showed that corn and cob meal was preferable to corn (*i.e.*, maize) meal, because of the lightening effect of the extra fibre. Maize has been used in this country to displace oats in the rations of horses, but has not gained any popularity; this is probably due to its comparative paucity in fibre (2 per cent. as compared with 10 per cent.), and to its forming a heavy meal, which, in the absence of fibre, will easily become an impervious mass in the stomach. In this connexion it might be mentioned that where horses have been fed on maize they have usually been given too much, since it is often used to displace oats in the ration pound for pound. The starch equivalent of maize is roughly 80 whilst that of oats is only 60, so that 3 lb. of maize will

correspond to 4 lb. of oats on a starch equivalent basis, and if this is borne in mind maize may be used in moderation mixed with oats, for then the latter will counteract the faults of the former by opening up the food mass in the stomach.

In the case of pigs, heavy meals such as barley meal or sharps are usually fed in the form of a slop, the large amount of water preventing the formation of a sticky paste—it is difficult to suggest any other reason to explain the fact that practice has shown that most of the best foods for pigs are of the heavy meal type. Probably one of the chief reasons

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Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follows :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	6 7
Maize	81	6·8	7 0
Decorticated ground nut cake	73	41·0	9 7
" cotton cake	71	34·0	10 10

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·69 shillings, and per unit protein equivalent, 2·31 shillings.

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended in the Report of the Committee on Rationing Dairy Cows should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	7 4
Oats	60	7·6	5 19
Barley	71	6·2	6 14
Potatoes	18	0·6	1 12
Swedes	7	0·7	0 13
Mangolds	7	0·4	0 13
Beans	66	20·0	7 18
Good meadow hay	37	4·6	3 13
Good oat straw	20	0·9	1 16
Good clover hay	38	7·0	4 0
Vetch and Oat silage	13	1·6	1 6
Barley Straw	23	0·7	2 0
Wheat straw	13	0·1	1 2
Bean straw	23	1·7	2 3

Description	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British..	—	—	8 5	0 12	7 13	72	2 1	1·12	9·6
Barley, British feeding ..	—	—	6 10	0 9	6 1	71	1 8	0·89	6·2
" Canadian feed	19 9	400	5 10*	0 9	5 1	71	1 5	0·76	6·2
" American	23 0	"	6 8	0 9	5 19	71	1 8	0·89	6·2
" Danubian	23 6	"	6 12	0 9	6 3	71	1 9	0·94	6·2
" Syrian	23 9	"	6 13§	0 9	6 4	71	1 9	0·94	6·2
" Tunisian	23 9	"	6 13§	0 9	6 4	71	1 9	0·94	6·2
Oats, English, white	—	—	5 15	0 10	5 5	60	1 9	0·94	7·6
" " black and grey	—	—	6 10*	0 10	6 0	60	2 0	1·07	7·6
" Argentine	16 9	320	5 17	0 10	5 7	60	1 9	0·94	7·6
" Chilian	17 9	"	6 5	0 10	5 15	60	1 11	1·03	7·6
" German	17 9	"	6 5	0 10	5 15	60	1 11	1·03	7·6
Maize, Argentine	27 3	480	6 7	0 10	5 17	81	1 5	0·76	6·8
" South African	33 0	"	7 13§	0 10	7 3	81	1 9	0·94	6·8
Beans, English winter ..	—	—	8 10†	1 4	7 6	66	2 3	1·20	20
" Chinese	—	—	9 12§	1 4	8 8	66	2 7	1·38	20
Peas, English blue	—	—	9 7†	1 1	8 6	69	2 5	1·29	18
" Japanese	—	—	16 15§	1 1	15 14	69	4 7	2·45	18
Dari	—	—	7 15§	0 11	7 4	74	1 11	1·03	7·2
Milling offals—									
Bran, British..	—	—	5 0	1 1	3 19	42	1 11	1·03	10
" broad	—	—	6 10	1 1	5 9	42	2 7	1·38	10
Middlings, fine, imported ..	—	—	6 5	0 17	5 8	69	1 7	0·85	12
" coarse, British ..	—	—	5 2	0 17	4 5	58	1 6	0·80	11
Pollards, imported	—	—	4 17	1 1	3 16	60	1 3	0·67	11
Meal, barley	—	—	7 12	0 9	7 3	71	2 0	1·07	6·2
" maize	—	—	7 0	0 10	6 10	81	1 7	0·85	6·8
" " South African ..	—	—	6 17	0 10	6 7	81	1 7	0·85	6·8
" " germ	—	—	7 0	0 15	6 5	85	1 6	0·80	10
" locust bean	—	—	8 5	0 7	7 18	71	2 3	1·20	3·6
" bean	—	—	11 0	1 4	9 16	66	3 0	1·61	20
" fish	—	—	19 0	3 3	15 17	53	6 0	3·21	48
Maize, cooked flaked	—	—	8 17	0 10	8 7	83	2 0	1·07	8·6
" gluten feed	—	—	8 5	0 19	7 6	76	1 11	1·03	19
Linseed cake, English, 12% oil	—	—	12 12	1 8	11 4	74	3 0	1·61	25
" " " 9% "	—	—	11 15	1 8	10 7	74	2 10	1·52	25
" " " 8% "	—	—	11 10	1 8	10 2	74	2 9	1·47	25
Soya bean cake, 5½% oil ..	—	—	9 0†	1 19	7 1	69	2 1	1.12	36
Cottonseed cake—									
English, 4½% oil	—	—	6 0	1 6	4 14	42	2 3	1·20	17
" " Egyptian, 4½%"	—	—	5 15	1 6	4 9	42	2 1	1·12	17
Decorticated cottonseed meal, 7% oil	—	—	10 0*	2 0	8 0	74	2 2	1·16	35
Ground-nut cake, 6-7% oil ..	—	—	7 10†	1 6	6 4	57	2 2	1·16	27
Decorticated ground-nut cake, 6-7% oil	—	—	9 7†	2 0	7 7	73	2 0	1·07	41
Palm kernel cake, 4½-5½% "	—	—	7 5†	0 17	6 8	75	1 8	0·89	17
" " " meal, 4½% "	—	—	7 15†	0 17	6 18	75	1 10	0·98	17
" " meal 1-2% oil ..	—	—	7 0†	0 17	6 3	71	1 9	0·94	17
Feeding treacle	—	—	6 7	0 9	5 18	51	2 4	1·25	2·7
Brewers' grains, dried ale ..	—	—	5 15	0 17	4 18	48	2 0	1·07	13
" " " porter	—	—	5 10	0 17	4 13	48	2 0	1·07	13
Malt culms	—	—	7 10§	1 6	6 4	43	2 11	1·56	16

* At Bristol. † At Hull. § At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of February and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £9 per ton, then since its manurial value is 17s. per ton as shown above, the food value per ton is £8 3s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 2d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·16d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding-stuff gives him the best value at the prices quoted on his own market. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N 8s. 10d. P_2O_5, 2s. 8d. K_2O, 3s. 4d.

why milk-fed calves should have frequent meals is that, in that way, only small clots are formed in the stomach, rather than larger ones into which the digestive juices penetrate only with difficulty.

The differences between the digestive tracts of the various farm animals give them different powers of utilizing foodstuffs. Cattle and sheep (particularly the former) are especially valuable as users of coarse fodder, whilst horses are not so efficient—with straw horses only digest about one-half as much as the ruminants, but with the better types of hay they are little more than 10 per cent. less efficient. The pig is a very economical converter of energy as long as it is fed on correct lines, but if the ration contains any considerable amount of fibre the " digestibility coefficient " sinks markedly. Different breeds of the same species have not been found to show any differences in their digestive powers, nor could American workers find any difference between pure-bred animals and scrubs in the percentage of nutrients digested, though it is to be supposed that improved animals would have greater capacity. Within the breeds, a certain amount of variation from animal to animal exists, but this is largely caused by factors more or less pathological in nature, such as bad teeth, worms, and so forth.

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MISCELLANEOUS NOTES

Reassessments of Grants : Higher Agricultural Education

THE Minister has appointed a Departmental Committee to consider and report what annual grants for the maintenance of Higher Agricultural (excluding Veterinary) Education should be made to institutions providing such education in England and Wales for the five academic years beginning on October 1, 1930. The Committee consists of the following :—

The Rt. Hon. Christopher Addison, M.D., M.P., Parliamentary Secretary to the Ministry,
Sir Douglas Newton, K.B.E., M.P.,
Professor R. Richards, M.P.

Dr. Addison will be Chairman of the Committee, and Mr. A. W. Knee, of the Ministry, will act as Secretary.

Export of Breeding Stock

NUMBER and declared value of animals, living for breeding, exported from Great Britain and Northern Ireland in the three months ended December, 1929, compared with the corresponding period of 1928. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	Oct. to Dec., 1929		Oct. to Dec., 1928	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	18	1,780	16	2,690
Belgium	22	892	10	109
Brazil	8	520	1	500
Colombia	7	1,190	9	1,320
Russia	194	12,305	106	6,919
Australia	23	6,120	0	0
British India	12	650	11	1,370
Canada	0	0	115	11,215
Irish Free State	634	11,064	385	7,898
Kenya	20	926	45	2,293
Union of South Africa	38	2,346	73	5,585
Other countries	22	1,341	34	2,872
Total	998	39,134	805	42,771
SHEEP AND LAMBS				
Argentina	459	15,675	442	12,844
Brazil	37	1,118	26	720
Chile	81	5,675	48	2,843
Russia	1,393	10,524	556	5,247
Uruguay	224	5,079	172	3,853
Australia	65	1,104	0	0
Canada	0	0	146	2,905
Falkland Islands	30	1,300	0	0
Irish Free State	74	668	439	3,011
Other countries	70	1,277	83	1,062
Total	2,433	42,420	1,912	32,485
SWINE				
Argentina	0	0	6	356
Belgium	11	210	8	96
Brazil	0	0	12	300
France	6	120	7	156
Japan	0	0	3	252
Russia	5	200	19	975
Australia	55	2,273	0	0
Irish Free State	119	476	42	494
Falkland Islands	0	0	35	105
Other countries	34	838	45	916
Total	230	4,017	177	3,650

Export of Breeding Stock in 1929

NUMBER and declared value of animals, living for breeding, exported from Great Britain and Northern Ireland during 1929, with comparative figures for 1928. (From "Annual Statement of Trade" and returns supplied by H.M. Customs and Excise.)

Country to which exported	1929		1928	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	242	53,248	297	48,441
Brazil	102	9,204	80	7,748
Chile	23	3,472	9	2,050
Russia	194	12,305	106	6,919
Uruguay	65	12,025	46	8,260
Australia	85	20,481	0	0
Canada	354	30,576	318	21,825
Irish Free State	2,198	48,332	2,023	40,304
Kenya	65	3,289	69	3,256
Southern Rhodesia	95	7,092	15	1,050
Union of South Africa	102	6,560	94	7,587
Other countries	150	11,086	118	8,049
Total	3,675	217,670	3,175	155,489
SHEEP AND LAMBS				
Argentina	868	25,625	737	19,710
Brazil	175	4,122	172	4,018
Chile	151	9,084	118	5,081
France	188	1,964	30	205
Russia	1,393	10,524	1,058	10,418
Uruguay	336	7,975	275	6,572
United States of America	140	2,242	58	800
Canada	277	2,643	402	5,316
Irish Free State	405	1,993	674	4,940
Other countries	350	7,873	194	2,419
Total	4,283	74,045	3,718	59,479
SWINE				
Argentina	22	430	14	578
Denmark	54	1,079	3	60
France	12	217	43	818
Hungary	63	888	29	830
Italy	5	58	29	984
Russia	5	200	63	2,040
Australia	68	2,837	0	0
Irish Free State	307	1,629	170	1,765
Union of South Africa	22	583	5	250
Other countries	160	2,940	154	2,917
Total	718	10,861	510	10,242

Varieties of English Blackberries in the United States

A NOTE by Mr. George M. Darrow in the United States *Year Book of Agriculture*, 1928, informs us that the value of the two varieties of English blackberries which were introduced into the States many years ago has aroused interest in all new English varieties. The United States Department of Agriculture has, therefore, introduced three varieties, Pollock, Sherlock Jr., and Edward Langley, while a fourth, Common British, has been obtained by the Ohio Experimental Station, and plants have been sent to the national Department of Agriculture for testing.

The following remarks upon American experience with these varieties are not without interest. The Common British resembles the broad-leaved type of the Evergreen introduced into America from this country about 75 years ago, and now found in New Jersey, Oregon and Washington. Its leaves are not so finely divided, and its berries ripen several days earlier and seem slightly larger. In other fruit and plant characteristics, including vigour and type of growth, it is not easily distinguished from the Evergreen. It should be tested in comparison with the Evergreen, especially because it ripens somewhat earlier and may extend the marketing season.

The Pollock and Sherlock Jr. resemble each other closely, and it is not certain that more than one should be grown. The Sherlock Jr. does not seem to be quite so hardy as the Evergreen, and hence it may be of most value in the milder portions of the districts where the Evergreen is grown and in regions with still milder climates. The plants are as vigorous as the Evergreen, healthy and productive, and the crop ripens several days before that variety. The hairy canes are biennial at Washington, D.C., but are perennial, like those of the Himalaya (the other variety of English bush introduced into America about 25 years ago), in California, where they bear year after year on the same canes. The berries are of fair size, firm like those of the Evergreen, with excellent flavour, and are easily picked from the long lateral fruit branches.

The Edward Langley does not produce quite as vigorous canes as the others; it is earlier than Himalaya; its leaves are mostly trifoliate, although some have five leaflets; its clusters are much more compact than the other European sorts; its berries are fully as soft as the Himalaya; but its

seeds are much smaller and its flavour is excellent. It is productive, but in California the berries are reported to separate with difficulty from the stems. In Maryland, no such difficulty has been encountered. If it does not prove generally difficult to pick, its high quality and small seeds commend it. It seems more promising for Pacific Coast conditions than for the eastern United States.

Sherlock Jr., Pollock and Edward Langley should probably all be trained as is the Evergreen in regions where the latter is grown. They are not adapted to the colder sections, but are recommended for trial in regions where temperatures below zero are rarely encountered.

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The Agricultural Index Number

PRICES of agricultural produce during February were on average 44 per cent. above those ruling in the base years, 1911-13, or the same as at the corresponding period of 1929, but four points below the January level. The fall on the month was due to the lower indices recorded for cereals, fat cattle and sheep, potatoes, hay and wool. The index figures for fat pigs and eggs, on the other hand, showed a rise.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925:—

Month	Percentage increase compared with the average of the corresponding month in 1911–13					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February ..	69	53	45	43	44	44
March	66	49	43	45	43	—
April	59	52	43	51	46	—
May	57	50	42	54	44	—
June	53	48	41	53	40	—
July	49	48	42	45	41	—
August	54	49	42	44	52	—
September ..	55	55	43	44	52	—
October	53	48	40	39	42	—
November ..	54	48	37	41	44	—
December ..	54	46	38	40	43	—

Grain.—Both wheat and barley became 6d. per cwt. cheaper in February, and the relative index numbers declined by nine and seven points respectively, barley selling at pre-war prices. The reduction in the case of oats amounted to 5d. per cwt., and the index figure was nine points lower at 8 per

cent. below the level of the base period. As compared with a year ago, wheat was 9d. per cwt. cheaper, barley 2s. 3d., and oats 3s. 2d.

Live Stock.—Prices of fat cattle were very slightly higher during the period under review, but as a proportionately larger increase took place between January and February of 1911-13, the index number was one point lower at 37 per cent. over pre-war. For the same reason, the index figure for fat sheep fell by 11 points, although average prices were not materially altered. Values for fat pigs continued to move upwards, baconers becoming 11d. per score lb. dearer at 95 per cent. and porkers 7d. per score dearer at 99 per cent. in excess of 1911-13. Dairy cows were about 10s. per head cheaper at 31 per cent. over pre-war, but prices of store cattle rose slightly and the index figure advanced by one point to 26 per cent. above the level of the base years. Store sheep again realized rather higher prices, but the increase was proportionately less pronounced than in the base years, and the index number dropped by six points to 49 per cent. in excess of the 1911-13 level. Similarly, a rise of close on 3s. 6d. per head in quotations for store pigs was insufficient to prevent a decline of two points in the index figure.

Dairy and Poultry Produce.—Milk was unchanged either in price or index number, but values for cheese appreciated by 3s. 6d. per cwt., the index advancing by two points to 39 per cent. over pre-war. Butter was a little cheaper at 43 per cent. above 1911-13, while the customary fall in egg prices at this time of the year was in evidence; the drop, however, was much less marked than in the base period, and the index figure was 11 points higher at 51 per cent. above pre-war. Fowls were dearer at 36 per cent. above the level of the base years.

Other Commodities.—A further substantial fall occurred in the prices of potatoes, and the index number dropped by 10 points to 14 per cent. below pre-war figures. A year ago, potatoes averaged 29 per cent. above pre-war. Most descriptions of vegetables became somewhat cheaper on the month, and the general index number was 14 points lower at 44 per cent. in excess of the 1911-13 level. The index figure for hay stood at 34 per cent. over the base period as against 38 per cent. in January. Wool again sold at lower prices, and the index declined by 14 points to 18 per cent. above pre-war. In February of last year wool realized 69 per cent. more than in 1911-13.

Index numbers of different commodities during recent months and in February, 1928 and 1929, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13.

Commodity	1928	1929			1930	
	Feb.	Feb.	Nov.	Dec.	Jan.	Feb.
Wheat	29	31	24	28	30	21
Barley	34	28	11	7	7	Nil
Oats..	42	36	6	2	1	—8*
Fat cattle	32	34	33	30	38	37
Fat sheep	56	56	53	53	67	56
Bacon pigs	38	50	56	64	90	95
Pork pigs	42	60	70	77	98	99
Dairy cows..	29	33	33	31	33	31
Store cattle..	25	23	15	17	25	26
Store sheep..	44	57	51	48	55	49
Store pigs	41	56	108	108	137	135
Eggs	33	68	54	47	40	51
Poultry	39	41	43	34	44	41
Milk	66	70	67	67	67	67
Butter	47	53	50	45	44	43
Cheese	59	74	32	32	37	39
Potatoes	71	29	18	10	—4*	—14*
Hay	12	4	41	41	38	34
Wool	62	69	41	39	32	18

* Decrease.

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German Milk Recording

ACCORDING to the *Deutsches Rinderleistungsbuch** the German milk-recording scheme was commenced in 1926 at the instigation of Herr Diecke-Peest on the lines of an American model. It was at first thought that it would not obtain very strong support and that few animals would be recorded, but the accumulated experience of the three years preceding the publication of the first report has shown this to be a mistaken opinion. In spite of the difficult position of German agriculture, the breeders have given the scheme their whole-hearted support, and results have been obtained which would have been unthinkable a few years ago.

The lowland farms of Northern Germany form much the larger number entered for the tests, and the list is headed by East Prussia followed by East Friesland. Schleswig-Holstein, Westphalia and the Rhineland are also represented,

* Band I, Berlin, 1929 (296 pp. illus.).

and great interest has been shown in the scheme in Bavaria, while tests have been going on in Wurtemburg for the past nine months.

The scheme is controlled by the Deutsche Landwirtschafts-Gesellschaft, through the medium of a special managing committee, and the current work is supervised by the Animal Breeding Institute of the Agricultural High School and University Institute. The working conditions are laid down under well-thought-out rules. Good results have already been obtained, and it is hoped through this scheme to devise correct rations for feeding in connexion with the scheme, and also for the feeding of the average milch cow.

Some of the extraordinarily high yields recorded could not have been anticipated before the scheme was set afoot. These have been achieved with cows which possessed high production capacity and which have been very richly fed, and although in certain quarters damage to the animals has been feared as a result of these intensive methods, the fears have proved groundless, because 325 cows, after undergoing the test, calved normally again within 14 months. It is suggested in the volume that the scheme will show foreign breeders that they might usefully invest in German beasts in order to build up their own herds, the special characteristics of the German animals not yet being so valued in foreign countries as they should be, while the effects of the recording on the German stock itself will no doubt be that of raising the general average standard.

* * * * * *

Travelling Research Fellowships and International Conference Grants.—The Ministry has awarded the following travelling research fellowships and international conference grants tenable during 1930 :—

(1) £50 each to Drs. B. A. Keen, E. M. Crowther and H. L. Richardson of the Rothamsted Experimental Station, and Professor N. M. Comber, of Leeds University, for attendance at meetings of the International Society of Soil Science, Russia, July 4-August 9, 1930.

(2) £50 each to Mr. J. Pryse Howell, of the University College of Wales, Aberystwyth, Mr. C. V. Dawe, of Bristol University, Mr. A. Jones, of the Midland Agricultural College, Sutton Bonington, Mr. A. Bridges, of the Agricultural Economics Research Institute, Oxford, Mr. W. H. Long, of the Seale Hayne Agricultural College, Newton Abbot, Devon, and Dr. J. A. Venn, of the School of Agriculture, Cambridge University, for attendance at the Second International Conference of Agricultural Economists at Cornell University, U.S.A., August, 1930.

(3) £200 to Mr. R. Boutflour, of the Harper Adams Agricultural College, Newport, Salop, for a visit to dairy research institutes in the U.S.A.

Grants for Visits of Foreign Scientists.—The Ministry has awarded a grant of £50 to the Rothamsted Experimental Station in respect of a visit of Professor G. Wiegner, of the Technische Hochschule, Zurich, for three weeks in the financial year 1930 for the purpose of lectures and discussions at certain Research Institutes and Colleges where soil problems are being studied.

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Journal of Dairy Research.—The United Kingdom imports more than half the butter and nearly half of all the cheese that enter into world trade, and the Dominions of Canada, Australia and New Zealand have enormously increased their output of dairy products during the last half century. The work of those engaged in dairy research is, therefore, of vast importance to the confederacy of States which goes to make up the Empire, but workers in the Empire have not hitherto had an organ which would enable them to keep in touch with the developments of their work which are published in many different journals and many different languages. A recommendation on the subject was made by the Imperial Agricultural Research Conference in 1927, and the Journal of Dairy Research has been instituted by the Dairy Research Committee of the Empire Marketing Board to supply this obvious and pressing need.

It is intended to include monographs by specialists reviewing the existing state of knowledge in different aspects of dairying, original contributions to dairy science by workers within the Empire, and reviews and abstracts of current literature.

The present number is prefaced by a foreword by Lord Passfield, and contains essays on *Feeding Standards for Dairy Cows*, by E. T. Halnan, M.A.; *Studies in Lactation*, by E. C. V. Mattick, M.Sc., Ph.D., and H. S. Hallett; *Rusty Spot in Cheddar and other Cheese*, by J. G. Davis, M.Sc., and A. T. R. Mattick, B.Sc.; *The Control of Bovine Tuberculosis in Canada*, by Dr. George Hilton, and the *Organization of Dairy Research in New Zealand*, by E. Marsden, in addition to what will be a most useful collection of abstracts and reviews. (Published half-yearly by the Cambridge University Press. Price 10s. net.)

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County Libraries in Great Britain and Ireland.—The 1928-29 Report of the Library Association, 27 Bedford Square, London, W.C. 1 (free on application), states that there are now 98 county libraries in the British Islands containing 2½ million books. The day has passed when the supply of a periodical parcel of books to different villages was considered the complete fulfilment of the duties of a county librarian. The present report explains the development of their activities and the work they are doing.

It is issued under the auspices of the Library Association and shows that it may now be accepted that this branch of public library work has passed out of the experimental stage. The services rendered by the libraries, which are fully described, are not only rural; there is co-operation with urban libraries, and in some cases arrangements have been made for the supply of books to schools for the use of pupils. The illustrations include plans and photographs of various types of library accommodation specially provided or adapted from other purposes to suit the work.

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Report of the Agricultural Economics Society.—The first report of this Society, founded in 1926, has now been issued, and records the number of ordinary members as 138, with 10 student associate members. The report gives accounts of the proceedings at the Conferences held by the Society in London on December 12, 1928, and

at Downing College, Cambridge, from June 21 to 24, 1929. Naturally several of the papers read dealt with different aspects of the agricultural depression. The presidential address of Mr. R. J. Thompson dealt with "Some Indications of the Nature and Extent of the Present Agricultural Depression"; and Professor A. W. Ashby and Messrs. J. Llefellys Davies, J. P. Maxton and R. R. Enfield contributed papers on phases of the subject. "The Development of Agricultural Economics in America" was described by Professor Ashby, and "Co-operative Marketing in Scottish Agriculture" was dealt with by Mr. T. G. Henderson, while a paper on "The Incidence of Notices to Quit and Rent Reductions as an Indication of Farming Conditions" was presented by Messrs. D. Skilbeck and M. Messer. The papers were followed by discussions. The report is published by the Society, and copies (price 2s. 6d.) can be obtained from the Hon Secretary, Mr. E. Thomas, University of Reading, 7 Redlands Road, Reading, by whom also particulars of membership will be furnished.

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Foot-and-Mouth Disease.—No case of foot-and-mouth disease has been confirmed in any part of Great Britain since that at Goring-by-Sea, Worthing, West Sussex, on December 23, 1929, the movement restrictions imposed in connexion with which were withdrawn on January 14.

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Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on February 25 and March 11, 1930, at 7 Whitehall Place, London, S.W. 1.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying into effect the Committees' decisions.

Durham.—An Order to come into operation on May 14, 1930 (when the existing rates are due to expire), and to continue in force until May 13, 1931. The minimum rates in the case of male workers of 21 years of age and over are:—for horsemen who are householders, 32s. per week of 50 hours with, in addition, 7s. per week to cover all time customarily spent in attention to horses; for horsemen who are not householders and who are not boarded and lodged, 31s. per week of 50 hours with, in addition, 3s. 6d. per week to cover all time customarily spent in attention to horses; for horsemen who are boarded and lodged, 31s. per week of 50 hours and any additional time customarily spent in attention to horses; for stockmen or shepherds who are householders, 43s. per week; for stockmen or shepherds who are not householders and who are not boarded and lodged, 36s. 10½d. per week, and for stockmen or shepherds who are boarded and lodged, 35s. per week, in each case for such hours as are customarily spent in attention to stock. The minimum rate for other male workers of 21 years of age and over is 31s. per week of 50 hours, except in the case of casual workers, when the rate is 6d. per hour. The overtime rate for all classes of male workers (other than casual workers) is 10d. per hour on Sundays, Christmas Day, Good Friday, and after 12 noon on Saturday, and 9d. per hour for all other overtime employment. In the case of female workers of 18 years of age and over, the minimum rate is 2s. 6d. per day of 8 hours with overtime at 4d. per hour.

Kent.—An Order continuing the operation of the existing minimum and overtime rates of wages from March 2, 1930 (when the existing rates are due to expire), until February 28, 1931. The

minimum rate in the case of horsemen, stockmen, or shepherds of 21 years of age and over is 33s. per week of 42½ hours in the weeks in which Good Friday and Christmas Day fall, and 52 hours in any other week, with, in addition, 8d. per hour for all employment on customary duties in excess of those hours, but not exceeding 60 in any week (including Sunday). The overtime rate in the case of these workers is 9d. per hour, except for employment on other than customary duties on Sundays, Good Friday and Christmas Day, when the rate is 10d. per hour. In the case of other male workers of 21 years of age and over, the minimum rate is 32s. 6d. per week of 42½ hours in the week in which Good Friday falls, 52 hours in any other week in summer, 39 hours in the week in which Christmas Day falls, and 48 hours in any other week in winter, with overtime at 9d. per hour on weekdays and 10d. per hour on Sundays, Good Friday and Christmas Day. In the case of female workers of 18 years of age and over, the minimum rate is 5½d. per hour, with overtime at 6½d. per hour on weekdays and 7d. per hour on Sundays, Good Friday and Christmas Day.

Lincolnshire (Kesteven and Lindsey).—An Order continuing the operation of the existing minimum and overtime rates from March 3, 1930 (when the existing rates are due to expire), until March 1, 1931. The minimum rate in the case of waggoners of 21 years of age and over is 39s. per week of 53 hours in summer, and 48 hours in winter, and such additional hours as may be required for the performance of the customary duties of such workers, but so that the total number of hours per week shall not exceed 61 during the period October 15 to May 13, and 58 during the remainder of the year. In the case of shepherds of 21 years of age and over, the minimum rate is 37s. per week of 53 hours in summer, and 48 hours in winter, and such additional hours as may be necessary for the performance of customary duties, but so as not to exceed a total of 55 in summer and 56 in winter, additional payments being made for the lambing season. In the case of stockmen of 21 years of age and over, the minimum rate is 38s. per week of 53 hours in summer and 48 hours in winter, and such additional hours as may be required for the performance of customary duties, but so that the total number of hours per week shall not exceed 56 in summer and 58 in winter. In the case of other male workers of 21 years of age and over, the minimum rate is 32s. per week of 48 hours in winter and 53 hours in summer. The overtime rates for all classes of male workers of 21 years of age and over are 9½d. per hour on weekdays and 11½d. per hour on Sundays. The minimum rate of wages for female workers of 17 years of age and over is 5½d. per hour for all time worked.

Middlesex.—An Order, continuing the operation of the existing minimum and overtime rates from March 1, 1930 (when the existing rates are due to expire), until February 28, 1931. The minimum rates in the case of male workers of 21 years of age and over are:—for stockmen, 41s. 3d. per week of 60 hours; for carters, 38s. 6d. per week of 56 hours; for casual workers, 8¼d. per hour, and for other male workers 34s. 4½d. per week of 50 hours in summer and 33s. per week of 48 hours in winter, with overtime in each case at 10¼d. per hour. The minimum rates in the case of female workers of 18 years of age and over are:—for stockmen, 30s. per week of 60 hours; for carters 28s. per week of 56 hours; for casual workers 6d. per hour and for other

female workers 25s. per week of 50 hours in summer and 24s. per week of 48 hours in winter, with overtime in each case at 7½d. per hour.

Monmouthshire.—An Order continuing the operation of the existing minimum and overtime rates of wages from March 16, 1930, until March 15, 1931. The minimum rate in the case of male workers of 21 years of age and over is 32s. per week of 54 hours in summer and 50 hours in winter, with overtime at 9½d. per hour on weekdays and 11½d. per hour on Sundays, Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and Boxing Day. The minimum rate in the case of female workers of 17 years of age and over is 6d. per hour for all time worked.

Glamorgan.—An Order, to come into operation on March 2, 1930 (when the existing rates are due to expire), and to continue in force until March 1, 1931. The minimum rate in the case of stockmen, cattlemen, cowmen, horsemen, shepherds and bailiffs of 21 years of age and over is 39s. per week of 60 hours, with overtime at 11d. per hour and, in the case of other male workers of the same age, 35s. per week of 52 hours in summer and 48 hours in winter, with overtime at 10d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over, the minimum rate is 6d. per hour, with overtime at 7d. per hour on weekdays and 7½d. per hour on Sundays.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Enforcement of Minimum Rates of Wages.—During the month ending March 14, legal proceedings were instituted against 12 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	d.	
Cornwall ..	Torpoint ..	2	0	0		—		39	14	0	2
Derby ..	Ashbourne ..	0	10	0		—		17	0	0	2
Gloucester ..	Littledean ..	1	0	0	0	13	6	64	15	3	1
Huntingdon	Ramsey ..	5	0	0		—		83	12	4	6
Lancaster .	Leyland ..	1	0	0	2	7	0	20	0	0	2
" ..	Widnes ..	4	0	0		—		65	0	0	2
Lincoln, Lindsey .	Gainsborough .	2	10	0		—		15	6	0	1
Monmouth .	Abergavenny .	0	1	0		—		8	13	6	1
Somerset ..	Taunton ..		—		1	4	0	25	0	0	3
Denbigh ..	Overton-on-Dee	1	1	0		—		10	16	6	1
Pembroke .	Fishguard ..	2	0	0		—		12	0	0	1
" .	Narberth ..		—		Case dismissed.						2
		£19	2	0	£4	4	6	£361	17	7	24

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False Information Given by Workers as to Conditions of Employment.—It is of general interest to all workers employed in agriculture to note that the obligation to furnish true information as to wages and hours of labour to an Inspector appointed for the purpose of securing the observance of the Agricultural Wages Board's Orders is applicable to workers equally as to employers, and that the Ministry

recently had occasion to prosecute a worker for an offence under the Act in this connexion.

It was pointed out during the hearing that proceedings could have been instituted under the Perjury Act involving the penalty of imprisonment up to two years.

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NOTICES OF BOOKS

Successful Poultry Farming. By T. W. Toovey. Pp. 113. Illus. (London : Crosby Lockwood & Son. 1930. Price 6s. net.)

Many people inquire whether they can make a living out of poultry farming : but few have the necessary capital and technical knowledge to make it possible. Contrary to what is generally thought, both are required in large measure, and Mr. Toovey, whose experience dates from 1899, makes this abundantly clear.

His methods are set out in detail, and, though they differ greatly from those used on the successful Norfolk poultry farm described by R. McG. Carslaw, M.A. (*Report No.* 5 of the Farm Economics Branch of the Cambridge School of Agriculture), there is no doubt that he knows the business, and, of course, there are more systems than one which can be successful.

Mr. Toovey's book describes his methods of housing, including the construction of houses, etc., as well as breeding and feeding, and his way of dealing with disease, which is largely preventive. Every branch of the business of producing both eggs and birds on a large scale is dealt with comprehensively. The prospective poultry farmer should certainly obtain this book, which also contains matter likely to be of service to the established man.

Flour Quality : Its Nature and Control. By E. A. Fisher, M.A., D.Sc. Technical Education Series. Pamphlet No. 3. Pp. 56. (London : The National Joint Industrial Council for the Flour Milling Industry, 26-28 King's Road, S.W. 3. Price 6d. net.)

This pamphlet, by the Director of the Research Association of British Flour Millers, goes fully into the question of wheat quality in its influence on the nature of flour, and describes the methods of treatment of flours derived from different kinds of wheat in order to render them of sufficient uniformity for various baking purposes. The public taste, of course, has played a large part in determining the objects to be aimed at, and the demand for more and more perfect whiteness in bread has justified increasing research into methods whereby this character can be obtained. As Dr. Fisher says, however, our knowledge of the real nature of the factors which go to form "baking quality" is slender, and no one of them is simple or completely understood. His pamphlet fully describes the present state of our knowledge, and is presented in as non-technical language as the nature of the subject permits.

Productive Sheep Husbandry. By W. C. Coffey, Ph.D. Second Edition, revised by William G. Kommlade, M.S. Pp. xxxii+479. Illustrated. (London: J. B. Lippincott Co. 1929. Price 12s. 6d. net.)

Although the area of the United States is so many times greater than that of the United Kingdom, and agriculture forms the occupation of a much larger proportion of the population, the number of sheep bred in the former country is quite out of proportion to its area. The actual figures are about 44½ million and 27½ million, respectively, or approximately 7·3 and 4·5 per cent. of the estimated world total. The wool production of the United Kingdom is, however, only 118½ million pounds as compared with some 328 million pounds in the United States. These figures suffice to show that conditions under which the sheep farmer works, and the objects he aims at, are different in the two countries, and this differ-

ence is made more apparent by the chapters of this book dealing with sheep management on the ranges in the Western States which find no comparable conditions in this country.

Since, however, the historical sections of the book admit that most of the popular breeds in the United States are derived from breeds native to this country, and a great deal of breeding is done under farm conditions, there is much here of interest to the British sheep farmer.

The various breeds are described in detail, with their suitability for different conditions of soil and climate. The whole business, from the establishing of flocks of small and large numbers, to the breeding, feeding, and marketing of wool and mutton, is carefully analysed. The suggestions for mating, care of ewes before and after the birth of lambs, and the care of lambs from birth to maturity, are practical and simply worded. Some of the feeds are crops not grown in this country, but most are common to both, and some particularity is given to the best rations which have been laid down by British investigators in animal nutrition, so that this book may confidently be recommended to the British reader, although some sections cannot be applicable to the conditions of this country.

The Economics of Farm Relief: A study of the Agricultural Problem. By Edwin R. A. Seligman, LL.D. Pp. xv + 303. (New York: Columbia University Press. 1929. Price 15s. net.)

The agricultural problem is of world-wide dimensions, and no country which was involved in the war is fortunate enough to be free of it. In America a much larger proportion of the population is engaged in farming than in this country, and up to the present America has been a country exporting agricultural products, while we have been for many years past mainly an importing country. In spite of these distinctions, however, we cannot afford to neglect a contribution to the solution of this urgent problem by so eminent an economist as Professor Seligman, whose reputation is international.

A careful examination of the development of American agriculture is supplied by the author as an introduction to the thesis that the war is ultimately at the bottom of the difficulties of the American farmer. While that view is shared by many economists in Europe, it is not the opinion of all. K. Ritter, writing on *Landwirtschaftliche Entwicklungs-tendenzen in der Welt* in the September, 1929, number of *Zeitschrift für die gesamte Staatwissenschaft*, states his view that the agrarian crisis in the world is not the result of the war, but of the bringing of agriculture into capitalistic economy. Rationalization, he thinks, tends to conflict with diminishing returns, and at present production is in excess of market demands, and consumption is limited by stationary birth-rates. Seligman, however, notes the tendency to capitalist economy before the war, and is in accord with the other factors of Ritter's findings. He would not like to see American farmers reduced to the position of the low standard cultivators of the peasant holdings in Europe, although he admits that these countries show a larger yield per acre than the United States.

It is, however, not so much with the causes of the crisis that we are now concerned, although a proper understanding of these causes is necessary before a remedy can be discovered. Professor Seligman has a great deal to suggest in this direction, but it is impossible in the space of a brief notice to give more than a hint of the nature of his suggestions; moreover, they may not be applicable as a whole to British conditions. At the same time they form a fertile source from which to draw ideas that can be modified so as to become suitable.

Many of the suggestions made are familiar. Amongst them may be numbered calamity insurance, co-operation, international action, regulation of speculation and transport, provision of credit, control of the incidence of taxation, education, the development of marketing facilities, price regulation, the control of the supply of produce to markets in years of exceptional plenty or dearth, and the acquisition by the State of submarginal farms for the purpose of afforestation. While these things are familiar they are presented here with a wealth of detailed reasoning that will well repay a careful study of the book by those who are to be responsible for the solution of the present difficulties. It may perhaps be added that the experience of the war in the control of price and the distribution of products, as set out in Professor Beveridge's recently issued contribution to the *Carnegie Economic and Social History of the World War*, under the title of *British Food Control*, is not unhelpful in this connexion.

The Country School: Its Practice and Problems. By M. K. Ashby. Pp. xii + 276. (Oxford: The University Press. 1929. Price 6s. net.)

In these days the possibilities for after-school development in the large industrial towns are so great and varied that less emphasis need be placed upon the importance of the primary schools there than in rural communities, but in the village the population is so small, the social organizations so few, although increasing, and the isolation so great, although diminishing with the extension of modern transport, that school experience is even more important than in the towns in influencing the later development or stagnation of the individual.

Miss Ashby's book stresses these points, and is also an emphasis of Mrs. Micawber's dictum that "Experientia does it" in this, as in other matters. Not only does the author give a brief history of the rural schools, but her analysis of the present position and future possibilities is masterly.

The work of the rural school is inextricably bound up with the social and economic life of the village. It is difficult to deal with dull and backward children, whose under-development is due primarily to parental poverty resulting in consistent under-feeding and malnutrition, and to the conditions of rural housing. Moreover, the parents' memories of their own natural hatred of totally unsuitable school conditions and curricula is sometimes a factor of antagonism against the best instructed modern teachers.

The possibilities are also limited in many districts by the school buildings and their deficient and unsuitable accommodation, both in space and in sanitary convenience. Many of the teaching staff, though some do excellent work, are untrained in the modern sense. Again, there are the questions of a rural bias in the type of education to be provided, and whether education in the villages should be more definitely of a vocational character than in the towns.

Miss Ashby deals with all these points carefully and thoroughly. She discusses the teaching of the children from its professional aspect, the kind of accommodation and equipment required to enable the best work to be done, the training of the teachers who will be necessary to continue the work, their social status in the village and their personal economic and social problems, and she treats of the central school for the older children of a group of villages, as well as of the further education of the village adolescents of both sexes by evening classes or continuation school, or winter farm institute courses.

It is true that education facilities are not the whole solution of the problems of village life. The economic factors bulk largely, as do other things, but this book suggests a basis upon which a scheme for a sound system of village education can be constructed, and that it may go a long way towards preparing our village children to live happily and contentedly in their natural environment, if and when some of their economic problems could be satisfactorily solved.

A Survey of the Soils of Buckinghamshire. By M. S. Temple, B.Sc. Pp. 130. (University of Reading: Faculty of Agric. & Hort. Bull. XXXVIII. 1929. Price 5s. net.)

Since this survey deals with the soils of the county in their relation to its agriculture, we may say that it is the third survey that has been published in just over one hundred years. Both of the earlier ones contain some account of the soils as well as a description of the agriculture of the county at the date when the survey was written. The system of description is not, however, uniform, the earlier reports giving in detail information which is presented in tabular statistical form in Mr. Temple's survey. This material was not, of course, available when the Rev. St. John Priest wrote his *General View of the Agriculture of Buckingham* in 1810, nor when Clare Sewell Read published his prize essay on the *Farming of Buckinghamshire* in the *Journal of the Royal Agricultural Society* for 1856.

It is not to be expected, of course, that there would be any material alterations in the soil of a county in so short a period as one hundred years, but a comparison of the maps which accompany each report shows that the earlier writers understood the variations almost as well as Mr. Temple. There is surprising coincidence in the soil maps, but this is not the case with regard to the way in which the land was and is used.

Broadly speaking, there has been little change in the distribution of the areas devoted to arable, dairy and mixed farming in this county during the past two centuries, but the shrinkage of the arable since the date of the Rev. St. John Priest's report is characteristic of a tendency that has become more marked all over the country more recently.

In 1810, the county could be divided into three sections in which the agriculture had distinct characteristics. All the Chilterns and south to the Thames, together with the sandy lands in the Brickhills, Soulbury, and Linslade, and some parts of the Vale of Aylesbury, were arable and contained very little pasture. From the Chilterns to Watling Street, excluding some parts of the Vale, were dairy farms, while to the north was an area of mixed farming. The ratio of ploughed land to pasture in these three districts was respectively 5 : 1, 1 : 16, and 5 : 3.

Fifty years later Read estimated that nine-tenths of the land in the district south of the Vale of Aylesbury was still under the plough, there being a strip of meadow along the Thames, but of the rest of the county not more than one-quarter was arable, and on the grass farms the cultivation of the ploughed land was quite subservient to the pastures. Read described the farming of the different districts in detail in relation to the soils.

The more accurate statistical information available to-day has enabled Mr. Temple to show that now only about one-half the cultivated area in the three districts into which he divides the south of the county is under arable, while in the Vale only 26·6 per cent. is arable. In the Ouse Valley the ploughed area is slightly higher, but in the northern clay plain only 10 per cent. is under tillage.

As Mr. Temple points out, there are two factors which influence the class of crop or crops that will be grown in a particular area, first the soil type and second the economic environment, and the connexion between these is brought out in the chapter dealing with the relation of soils to crops. Such surveys are of great service, not only as of historical importance in showing what was the use of the land at particular periods, but to those who are working the land now. When sufficient surveys have been published, it may be possible to collate them with the costings work in progress all over the country and to arrive at a mean between soil and economic environment accurate enough to determine the best method of farming in different districts.

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ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Seale-Hayne Agricultural College and Dartington Hall, Totnes.—Report No. 1: An Agricultural Survey in South Devon, by *J. R. Currie* and *W. H. Long*. (204 pp.) Newton Abbot and Totnes, August, 1929. [31(42); 338·1(42); 63(42).]

Wrightson, J., and *Newsham, J. C.*—Agriculture: Theoretical and Practical. (Third edition.) (648 pp.) London: Crosby Lockwood, 1929, 12s. 6d. [63.]

Nicholls, Sir H. A., and *Holland, J. H.*—A Text-book of Tropical Agriculture. (Second Edition.) (639 pp.) London: Macmillan & Co., 1929, 15s. [63 (024).]

Ainslie, J.—The Gentleman and Farmer's Pocket Companion and Assistant. (180+14 pp.) Edinburgh, 1802. [52; 63.]

U.S. Chamber of Commerce, Agricultural Service Department.—Large-scale Farming. (36 pp., neostyled.) Washington, 1929. [338.1; 63.191.]

Orwin, C. S.—The Reclamation of Exmoor Forest. (172 pp.+24 pl. and 5 maps.) Oxford University Press; London: Humphrey Milford, 1929, 10s. 6d. [63 (09); 63.12.]

Turnor, C.—The Land: Agriculture and National Economy. With a foreword by *Lord Bledisloe*. (80 pp.) London: John Lane, The Bodley Head, Ltd., 1929, 1s. [338.1 (42).]

Hole, S.—Agriculture and Industry. How they can benefit each other. An appeal for the reconciliation of Industrial and Agricultural Economics. (38 pp.) The Author, Hassocks, Sussex, 1929. [337; 338.1 (42); 338.98.]

Gordon, R. A.—A Handbook on Compulsory Acquisition of Land and Compensation. (302 pp.) London: Stevens & Sons, 1929, 12s. 6d. [333; 347.]

Mitchell, G. S.—A Handbook of Land Drainage. (Third Edition.) (118 pp.) London: Land Agents' Record, 1929. 5s. [63.14.]

Bews, J. W.—The World's Grasses: their Differentiation, Distribution, Economics and Ecology. (408 pp.) London: Longmans, Green, 1929, 21s. [58.2; 58.3.]

Rider, S. W., and *Trueman, A. E.*—South Wales: A Physical and Economic Geography. (190 pp.) London: Methuen, 1929, 4s. [338 (429); 338.1 (429); 91.]

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University of Oxford, Institute for Research in Agricultural Engineering.—Bulletin No. 4: A Report on the Development and Costs of the Oxford Process for the Production of Sugar from Sugar Beet. (55 pp.+5 pl. + 6 plans.) Oxford: Clarendon Press; London: Humphrey Milford, 1929, 2s. 6d. [664.1.]

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Hogarth, A. M.—The Rat: A World Menace. (112 pp.) London: Bale, Sons & Danielsson, 1929, 7s. 6d. [63.269.]

U.S. Department of Agriculture.—Miscellaneous Publication No. 36: A History of Agricultural Education in the United States, 1785–1925, by *A. C. True*. (436 pp.) Washington, 1929. [37 (73).]

Colony of the Gambia.—The Annual Report of the Department of Agriculture for the Year 1928–29. (54 pp.+2 pl. and plan.) London: Crown Agents for the Colonies, 1929, 5s.

France.—Premier Congrès National de L'Ensilage des Fourrages,

tenu à Toulouse, Mars 27, 1927. Mémoires et Comptes Rendus. (443 pp.) Paris, 1 Place Valhubert, 1928. [63 (063); 63.19832.]

Institut Colonial de Marseille.—Congrès des Docks et Silos à Céréales de L'Afrique du Nord, Marseille, Septembre 27–30, 1928. Compte Rendu et Rapports. (320 pp.) Marseille, 1929. [63.31–198; 63.31: 38.]

U. d. S.S.R. Internationalen Agrar-Instituts.—Beiträge zum Studium der Internationalen Agrarfrage, Band 1: Die Bauernbewegung in der Russischen Revolution 1917, by *S. Dubrowski.* (206 pp.) Berlin: Paul Parey, 1929. [331 (47); 338.1 (47.]

Agricultural Machinery

Smith, H. P.—Farm Machinery and Equipment. (448 pp.) New York and London: McGraw-Hill Publishing Co., 1929, 16s. 3d. [63.17.]

Canada, Department of Agriculture.—Bulletin No. 118, New Series: Seven Years' Experience with the Combined Reaper-Thresher, 1922–28. (27 pp.) Ottawa, 1929. [63.17.]

U.S. Department of Agriculture.—Farmers' Bulletin, No. 1608: The Operation and Care of the Combined Harvester-Thresher. (14 pp.) Washington, 1929. [63.17.]

Michigan Agricultural Experiment Station.—Circular Bulletin, No. 126: Essentials of a Mulch Paper Laying Machine. (7 pp.) East Lansing, 1929. [63.17; 63.191.]

Field Crops

U.S. Department of Agriculture.—Technical Bulletin, No. 133: Flax Cropping in Mixture with Wheat, Oats and Barley. (48 pp.) Washington, 1929. [63.191; 63.31; 63.34111.]

U.S. Department of Agriculture.—Technical Bulletin, No. 141: The Spontaneous Combustion of Hay. (37 pp.) Washington, 1929. [63.1982.]

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NOTES FOR THE MONTH

Fruit Crop Intelligence

THOSE concerned in making forward sales of fruit realize that the buyer often has more information concerning the size of crops than the seller, whose main business is production. The grower knows the size of his own crops and probably can guess whether those of his neighbours are better or worse than those of previous years, but at the most his knowledge is very local and certainly too limited to serve as a guide for estimating probable market prices.

On the other hand, a large fruit dealer obtains his supplies from very wide sources and soon establishes machinery for obtaining information as to the size of the crop at each centre. The combined information from all sources gives some idea as to the total marketable crops. The fruit-producing areas are widely separated, and for any one crop may extend almost from one end of the world to the other. The supplies of apples in the English markets, for instance, may depend less on the home crop than on that of the orchards in North America; cherry supplies depend on the crops in Kent, Belgium and the Rhone Valley of France; and the blackcurrant market is influenced by production in France and the Netherlands, as well as by the home crop.

Exact information concerning the crop in any one district, though valuable in itself, provides no guide as to the total supplies likely to be available for the market. Indeed, such limited knowledge may lead the seller to act to the detriment of his own interests, *e.g.*, by encouraging him to withhold supplies when the full facts of the situation would show this course to be inadvisable. A full knowledge of the fruit crops in the districts that matter, therefore, is fundamental to organized and proper marketing; it is important to the producer of top fruits, and vital to the grower of soft fruits who frequently trades in bulk to jam factories and canneries at forward prices. This full and accurate information is not easy to obtain in complete form just when it is wanted, but by taking pains and making some study it is possible for the

home grower to get a fairly true idea of the crops in which he is concerned.

Home Crop Reports.—Anyone interested in the position of the home crops should consult the reports on horticultural crop conditions issued monthly by the Ministry. These reports are compiled from information furnished by observers in all the chief fruit-growing areas, and cover the whole of the period from blossoming time until the maturity of the various crops. In addition, estimates of the probable yields per acre of the several fruit crops are made at appropriate dates during the season. These estimates, and the monthly crop reports, are published in the Ministry's Agricultural Market Report, in the Empire Marketing Board's Weekly Fruit Intelligence Notes, to which reference is made below, and also in the trade press. Growers who read all these reports are able to obtain accurate knowledge that will give a fairly correct idea of the "home" fruit crops.

Reports of Crops in Other Countries.—The grower also needs information as to crop prospects in parts of the Empire and foreign countries which normally send fruits to the British market. The collection of such information is not easy, for in most instances it is not given in the publications issued by other Departments of Agriculture. Anyone sent over to a strange country would find it impracticable to form an accurate estimate of the condition of any crop. Arrangements, however, have been made by the Empire Marketing Board for obtaining reports on the condition of the fruit crop of the particular districts in foreign countries which exercise most influence on our markets; for example, the cherry districts of France, Belgium and the Netherlands; the plum districts of France, Italy and Spain; the cider-apple districts of France; and the blackcurrant and strawberry districts of France and the Netherlands.

From the reports sent from these districts, the Empire Marketing Board are able to publish, in their Weekly Fruit Intelligence Notes, information as to the condition of these "foreign" crops. It is improbable that any single one of these notes can provide more than an indication of the crop behaviour, but a study of all the notes should provide some idea of the fruit crops abroad, and the information in respect of each kind of fruit on the Continent is summarized in the Board's "Notes" before the opening of the season. The "Notes" make no attempt to forecast the volume of imports to this country from each district, for factors other than the size of crop also influence these, but usually the size of the crops on the Continent and shipments to other countries are closely

related, and some attempt is made by the Empire Marketing Board to estimate whether imports into the United Kingdom are likely to be greater or less than average. During the course of the soft fruit season, also, the Board publishes a table showing aggregate imports of each fruit from week to week, from which the grower can compare the season's imports with those of preceding seasons.

The "Notes" issued by the Empire Marketing Board provide information of real interest, and should be read by all commercial growers. During the past two years the Board has made a small charge (5s. per annum post free) for the Notes, though this is waived for commercial fruit growers in the Empire. In fact, by sending a postcard to the Board, asking to be put on the standing list, Empire growers may receive the Weekly Fruit Intelligence Notes regularly free of all charge.

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Wild White Clover

THE importance of including wild white clover in seed mixtures used when land is sown for a permanent pasture or for long duration leys cannot be overemphasized. Although its value was appreciated to some extent before 1906, the experiments which were carried out at Cockle Park from that year onwards have firmly established its importance. Its particular value in the formation of a permanent pasture is due to (*a*) its high nutritive properties; (*b*) the rapidity with which it forms a sward, and thus keeps out weeds; (*c*) its beneficial effect on the grasses associated with it, and on the fertility of the land for subsequent arable crops when the field is broken up and the turf is ploughed down; (*d*) its practical immunity from clover sickness; and (*e*) its persistence in comparison with commercial white or Dutch clover, which quickly dies out.

The seed of wild white clover does not differ from that of white Dutch in any absolute character, but having regard to the considerable difference in the value to the farmer of the two types of seed it is of the greatest importance that he should be certain that he is getting the genuine article.

In order to help the farmer in this connexion, a scheme has recently been launched by the National Farmers' Union in co-operation with the Ministry, as indicated in this JOURNAL for March, 1930, p. 1134, providing for the inspection and certification of fields of genuine wild white clover which are intended to be saved for seed purposes. Growers who wish to

avail themselves of this certification scheme are invited to communicate with their county branch of the National Farmers' Union, from whom full particulars can be obtained. (Application for field inspections to be carried out this year had to be sent in by April 15.)

* * * * * *

Barley Meal

CONSIDERABLE difference of opinion appears to exist as to the meaning of the definition of "barley meal" contained in the Fourth Schedule to the Fertilizers and Feeding Stuffs Act, 1926. The term "commercially pure barley, as grown" has been claimed to mean that any crop, however foul, which is mainly barley can be ground and sold as "barley meal" provided nothing has been extracted from or added to the grain obtained by threshing such a crop.

The Ministry desires to express the opinion that barley is not commercially pure unless it would be accepted by a well-informed purchaser as a proper delivery in fulfilment of a contract for the purchase of barley; and that a crop of barley containing a large proportion of other grains and weed seeds would not be "commercially pure" even though it were, in fact, "*as grown*."

In considering whether it should consent to a prosecution for an alleged false description of an article as "barley meal," the Ministry would take into consideration the question whether the barley was commercially pure in the sense above indicated; and the same general principle would, of course, apply in respect of other names which are similarly defined in the Fourth Schedule.

* * * * * *

Bajra or Bullrush Millet as a Feed for Pigs

THE following note has been communicated by Mr. A. N. Duckham, M.A., Dip.Agric., late of the Animal Nutrition Institute, Department of Agriculture, Cambridge:—

In recent years a considerable amount of research on protein feeds (such as fish meal, soya meal) and mineral supplements has been successfully carried out, and the experimental results obtained are now being applied on many farms. Thus, although many problems relating to the protein and mineral feeding of pigs remain unsolved, a position has been reached where attention can be turned to the possibility of cheapening the cereal section of pig-feeding rations. Experiments at Cambridge with grated sugar beets and sugar beet pulp, and at Harper Adams with tapioca feed (*syn.* manioc, cassava), have shown that both grated sugar beets and tapioca may be used as partial substitutes for the standard pig-feeding cereals, but that sugar beet pulp cannot be regarded as an entirely suitable feed for rapidly growing pigs. Further experiments on these lines are now proceeding at Cambridge to determine the value of sago-pith meal as a cereal substitute. This note, however, refers to an experiment on Bajra (*syn.* Bullrush, Spiked, Catstail or Pearl Millet) carried out on a sample from Nyasaland at the request of the Empire Cotton Growing Association.

The Bajra was used as a *complete* substitute for barley meal in the 65—25—10 ration (65 barley meal, 25 middlings, 10 fish meal, parts by weight). One group of seven Large White pigs was fed on the above control ration and another evenly selected group was fed on a ration of Bajra 65, middlings 25, fish meal 10. For the last few weeks before slaughter the rations were Bajra or barley meal 80, middlings 15, fish meal 5.

Both groups of pigs were slightly under 100 lb. average live weight at the beginning of the experiment, which was carried on for 10 weeks, after which the average live weights were: Control Group, 206·2 lb.; Bajra, 214·2 lb. The average live weight gain per day was: Control, 1·57 lb.; Bajra, 1·67 lb. The quantity of feed consumed per pound of live weight gain was: Control, 4·08 lb.; Bajra, 3·93 lb. In view, however, of the small number of pigs used and the shortness of the experiment these differences (being only about 5 per cent.) cannot be regarded as significant. At the end of the experiment both groups were sold to the St. Edmundsbury Co-operative Bacon Factory, Ltd., Elmswell, Suffolk, and treated as recorded pigs under the East Anglian Pig Recording Scheme. There were no significant differences between the groups as regards loss from live to dead weight, loss from dead to curing weight, and length of carcass, but the Bajra group averaged 10 per cent. thicker back fat. The grading suggested that the Control group yielded rather better bacon carcasses than the Bajra, but while the former tended to be unfinished the latter were well finished, rather fat, and strikingly firm. These observations were confirmed by inspection of the resultant bacon.

It may be concluded that meal made from Bajra (*Pennisetum spicatum* Roem and Schult. *syn. P. typhoideum* L. Rich, *P. glaucum* R. Br.) of that type grown in Nyasaland is a suitable substitute for barley meal as a feed for bacon and probably

other pigs. This conclusion is confirmed by Hahnan's work with poultry. It must be clearly understood, however, that these results apply only to this species of grain and not to the many other species of small cereals commonly known as millets, or even to those varieties of Bajra which do not yield a naked grain when thrashed. The latter, and the millets as a whole, have a high fibre content (largely due to the fact that the glumes cannot be completely removed from the grain by thrashing) which make them relatively unsuitable pig feeds. It is possible that, from the pig-feeding point of view, the finger millet or "Ragi" of India (*Eleusine coracana*, Geart), which has an analysis similar to the naked grain types of Bajra, might prove a valuable exception to this generalization.

Bajra is extensively grown in the old-world tropics, and both in India and Africa forms, in many parts, the staple grain food of the human population. If an export trade could be built up it is probable that it would not only benefit the British farmer, who should ultimately be able to obtain this grain substantially below the price of barley, but that it would help to increase the purchasing power of the native population. Care must be taken, however, that only varieties with a low fibre content are offered for pig feeding on the home market.

* * * * * *

Conference of Empire Horticulturists

ADVANTAGE is being taken of the meeting in London next August of the Ninth International Horticultural Congress, and the consequent presence in this country of horticulturists from different parts of the Empire, to organize a Conference of Empire Horticulturists for the days immediately preceding this Congress. The Conference will be organized by the Imperial Bureau of Fruit Production, The Research Station, East Malling, Kent, and will take place on August 5–7.

It is hoped that the Conference will form the basis for valuable discussion and interchange of ideas between horticulturists throughout the Empire. Papers will be be given by leading horticultural experts from this country and from overseas, the following subjects receiving consideration :—

The work of the Imperial Bureau of Fruit Production; Possible development of fruit growing in the Empire; Methods of horticultural research, such as the lay-out of field experiments, the application of soil survey work and meteorological observations, and approach through the pure sciences. Progress in fruit storage methods will also be reviewed, and the sources and training of horticultural research workers discussed.

The Conference will be opened by Sir Robert Greig, M.C., LL.D., Chairman of the Executive Council of the Imperial Agricultural Bureaux, at 10 a.m. on Tuesday, August 5.

Further details may be obtained on application to the Imperial Bureau of Fruit Production, or to the headquarters of the Imperial Agricultural Bureaux, 2 Queen Anne's Gate Buildings, Westminster, S.W.1.

* * * * * *

Exportation of Horses

IN view of the disturbing and misleading allegations made in certain recent newspaper articles concerning the export of horses for immediate slaughter, the Ministry desires to give publicity to the facts, which are as follows :—

The law of Great Britain prohibits the shipment from this country of any horse unless it has been examined by a Veterinary Inspector of the Ministry immediately before shipment, and passed as fit to travel and also to work without suffering. This prohibition is very rigidly enforced, and the Ministry has not reduced in the slightest degree the high standard of fitness which has now for some years been adopted in respect of every horse passed for export. It may be accepted that no horse which could be described as decrepit or worn out is allowed to be exported.

The recent newspaper articles could only have led the public to believe that 200 or more horses are sent to the Continent every week from these shores to be slaughtered at certain abattoirs in France under ghastly and cruel conditions. Nothing could be farther from the truth.

During 1929 the total number of horses passed for shipment to the Continent was 9,912. According to the information furnished to the Ministry's Inspectors at the ports at the time of shipment, 4,371 of these were intended for slaughter on arrival abroad, and all but 29 of the latter went to Holland, where the use of the humane killer is made compulsory by law and where the public abattoirs are among the best in the world. According to the information received by the Ministry the remaining 29 were all slaughtered with the humane killer at the Boulogne abattoir.

It will be recalled that the export trade in horses was thoroughly investigated in 1925 by a Departmental Committee, who reported that they were satisfied that the provisions of the Exportation of Horses Acts were efficiently

carried out, and that the closing of the Continental market to horses from this country passed as fit to work could not be justified on any grounds.

* * * * * *

Agricultural Fortnight in Belgium

INTERNATIONAL exhibitions will be held at Antwerp and Liege this year and, by arrangement with the authorities of these exhibitions, a number of international congresses bearing on agriculture will be held during the first fortnight in August. These congresses have been grouped into an agricultural fortnight in order to allow the participating countries, bodies, institutions and associations to send as many delegates as possible at a minimum of cost.

The following is the provisional programme of these congresses :—

August	Antwerp	Liege
1 and 2 :	Horticulture.	
3 :	Visit to Liege.	
4 and 5 :	Reclamation.	Domestic education.
6 :	Visit to Liege.	Rural engineering ; domestic education.
6 and 7 :	Goat breeding.	Domestic education ; visit to Antwerp.
7 :	Meeting at Brussels of the Agricultural Section of the Commercial International Parliamentary Conference. The morning meeting will be held at the Palais des Académies ; a garden party will be given in the afternoon.	
8 :	Visit to Liege, Parliamentary Section.	Visit to Antwerp.
8 and 9 :	Congress of Farmers' Wives' Clubs.	Improvement of rural life.
10 :	Visit to Liege.	Visit to Antwerp.
9, 10 and 11 :	Agricultural associations.	Collegiate and secondary agricultural education.
12 :	Visit to Liege.	Visit to Antwerp.
12 and 13 :	Primary and domestic rural education.	
13 and 14 :		Excursions.
14 :	Visit to Liege.	Concluding general meeting.

Each congress will issue a special programme of its own proceedings, but for all further information as to fees payable, etc., inquiries should, in the first place, be addressed to the Secrétariat-Général de la Quinzaine-Internationale, Rue des Joyeuses-Entrées 40, Louvain, Belgium.

It may be added that an International Zootechnical Congress will also be held in June, and a similar Congress on Pomology will be held in September of this year. Information regarding these congresses can also be obtained from the address given above.

Field Drainage, Rural Water Supply and Claying of Fen Lands

As announced last August, funds have been placed at the disposal of the Ministry for the purpose of assisting schemes of field drainage and water supply on agricultural holdings, for the alleviation of unemployment and the improvement of agricultural land and conditions in rural areas. This assistance has since been extended to the claying of fen lands. Applications for grants are made by landowners to the County Agricultural Committees, who inspect the sites of the proposed works and report to the Ministry in the case of approved schemes. Schemes are also under the general supervision of the Ministry's Land Commissioners.

The nature of the schemes which the Ministry is authorized to assist is as follows :—

Field Drainage.—The drainage, usually by means of pipes, of agricultural land into existing natural or artificial outfalls.

Water Supply.—The supply of water to groups of agricultural holdings. Work being done under these schemes consists of connecting holdings, etc., to existing water mains, the sinking of wells, installation of pumping machinery, construction of reservoirs, supply of drinking troughs to fields, etc., and the laying of the necessary pipe connexions.

Claying of Fen Lands.—This consists of cutting deep trenches, taking out clay and spreading it on the surface. Besides improving the quality of the land the operation assists drainage.

Briefly the grants offered by the Ministry to owners of agricultural land in aid of approved schemes are as follows :—

(a) A maximum of 33⅓ per cent. of the actual net cost of the work, or, in the case of field drainage, £6 per acre, which ever is the smaller.

(b) In the non-depressed areas, a maximum of 50 per cent. of the cost, provided that not less than 50 per cent. of the labour is obtained through the Employment Exchanges from certain depressed areas.

All unemployed labour must be obtained through the Employment Exchanges.

The wages of ordinary estate staff are not eligible to rank for grant.

The Ministry has so far approved 249 schemes of field drainage, 74 schemes of water supply, and 30 schemes of claying of fen lands. The approvals extend over 45 county areas.

World Poultry Congress

IN the past month, the arrangements for the Congress to be held at the Crystal Palace in July next have moved rapidly and prosperously. The number of countries represented has risen to 55. Nearly 20 national exhibits are to be staged. The programme of entertainment has been extended in many directions; and the space originally allotted to trade exhibits was so eagerly taken up that an extension of the galleries became necessary, and the limit of this extension has very nearly been reached. The time is approaching when applicants must be told that there is no room for them. The Ministry of Agriculture, as organizer of the Congress, has gratefully to acknowledge the generous support of Local Authorities in general, and of the poultry instructors in particular. Much depended upon their ungrudging assistance; this has been forthcoming and must be regarded as one of the main factors that have contributed largely to the progress made in rousing public interest. The National Farmers' Union is another great body that is giving the Congress unstinted support, and has reserved an excellent site for a reception room for its members and has circularized its county branches. It is needless to say that the goodwill of the industry has been expressed in the most effective fashion possible. The poultry breeders have responded to the invitation to exhibit their best, and although the final figures cannot yet be ascertained, it is safe to say that the British exhibit will double, or even treble, that of its nearest friendly competitor. This is as it should be, because the Fourth World Poultry Congress can hardly be held in England again in the lifetime of the present generation, and the British poultry industry is only now beginning to show what it can do to supply the home demand.

His Royal Highness the Duke of York has kindly consented to open the Congress at three o'clock on July 22, and so far as can be seen from the response of Europe, Asia, Africa and the Americas, this Congress should register an even higher level of achievement than its predecessors.

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THE ROLE OF VITAMINS AND MINERALS IN STOCK FEEDING

II.—MINERALS

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IT has long been known that food must contain lime and phosphorus for the formation of bone, and other inorganic salts for the blood and soft tissues. As early as the beginning of last century it was recognized that the lack of these might be the cause of disease in sheep and cattle. By the middle of last century it was proved that some diseases which occurred in cattle in certain districts on the Continent, especially in the winter months and in seasons of drought, were due to the lack of either lime or phosphorus in the pasture or fodder. In 1875, McMillan stated that "when sheep have to graze upon grass which does not contain all the earthy matters required, they will become poor in quality and predisposed to disease." It was also shown by experiments that animals might suffer from lack of sufficient common salt.

Towards the end of last century, however, students of nutrition were so engrossed in the study of the energy (or starch) and protein requirements of animals that little attention was paid to the observations of these early writers, and it was generally assumed that though mineral salts were obviously necessary, any ordinary ration would be likely to supply a sufficiency provided the "starch value" and the "protein ratio" were correct. It was obvious, however, to clinical observers that there were certain diseases in farm animals which appeared to be of nutritional origin and which could not be attributed to a too low starch value or to an incorrect protein ratio, and the cause of these diseases was sought for in lack of either vitamins or minerals. Fortunately, it was in farm animals that these diseases were first noted; hence a great part of the research work on minerals has been done with farm animals, especially with pigs and cattle.

Investigation has shown that certain diseases which occur in various parts of the world under ordinary farming conditions are due primarily to a lack of one or other of the minerals. In parts of South Africa, Australia and the United States, lack of phosphorus in the pastures is associated with a disease which goes by various names, but which is characterized during the life of the animal by stiffness of gait, slow growth, poor breeding capacity, general unthriftiness, and pica (*i.e.* a "depraved" appetite for substances such as old

bones or earth), and, on post-mortem examination, by a soft or brittle condition of the bones. A somewhat similar condition in pigs, also accompanied by pica, usually manifested by rooting, is common both in this country and in parts of the United States. It has been shown to be in many cases associated with a deficiency of lime. It has also been shown, under experimental conditions, that lack of lime in the rations of cows may be the cause of failure to breed successfully, the calves being either born dead or with such low vitality that the death rate is high. Lack of sodium and chlorine, which are both contained in common salt, has been proved to be a cause of unthriftiness in milk cows.

Attention has also been directed to some other minerals which are required only in very small amounts, lack of which in the diet may be associated with disease. Thus it has been found that in some rations which might be fed even under practical conditions the lack of iron may be the cause of anæmia in young pigs. In certain districts of the world a shortage of iodine in the herbage or other locally grown foodstuffs has been thought to be associated with a disease called "goitre" in cattle and sheep, and with the birth of dead or defectively formed young, especially in pigs. It should be noted that the cases of gross diseases referred to above were caused only by very marked deficiencies either in natural pastures or in experimental rations. Except in the case of pigs such gross deficiencies are not liable to occur to any extent on arable farms in this country, where, owing to the use of manures and fertilizers, the pastures and crops are usually of fairly good composition. It is believed, however, that deficiencies, less marked than those referred to above as the direct cause of disease, may exist and be the cause of a degree of malnutrition which affects rate of growth and production, and may possibly render the animals more susceptible to other diseases.

The recognition that deficiencies of minerals, in some parts of the world, may be the cause of diseases of great economic importance, and may even under good farming conditions be the cause of malnutrition, has stimulated research to find out the amounts present in foodstuffs. Our information upon the amounts required by different animals and upon the factors which affect the utilization of the minerals is still very incomplete, in spite of the work which has been done. There is, however, a certain amount of fairly well established information which may serve as a guide in attempts to balance the rations of farm animals with regard to their mineral content.

We will deal here first with calcium (lime), phosphorus, sodium and chlorine (common salt), which are needed in relatively large amounts, and then with iron and iodine which are required only in minute traces. As far as we know at present these are the minerals most liable to be deficient under ordinary conditions.

Calcium (Lime), Phosphorus, Sodium and Chlorine.—It is easy to calculate from the known composition of the carcasses of animals, or of products such as milk and eggs, the amounts of each of the different minerals which must be absorbed from the intestine and retained in the body for the building up of the bones and other tissues in growth, or used for the elaboration of products such as milk and eggs. For example, calcium (calculated as lime, CaO) is present in the bodies of store cattle to the extent of about 2 per cent., and of growing pigs to the extent of about 1 per cent. Therefore young cattle putting on 2 lb. per day live weight would need to absorb and retain rather more than ½ oz. per day, and pigs putting on the same weight, about ¼ oz. Every gallon of milk contains about ¼ oz.; hence a cow giving 4 gallons of milk a day would lose each day about 1 oz. in the milk.

Only part of what is contained in the food is absorbed from the intestine and even what is absorbed is not all available for formation of new tissue or for milk, because there is a continuous loss in the excretions. Hence the food must contain more than is required to be retained in the body or secreted in the milk or eggs.

Of the minerals under discussion, the one most difficult of absorption is calcium. The proportion absorbed from the intestine may vary from practically nothing to over 70 per cent. according to the nature of the ration. A young sucking animal can absorb and retain over 70 per cent. of the calcium in its mother's milk. On the other hand, on a badly balanced ration poor in calcium and in the factors which facilitate its assimilation, the amount absorbed may be practically nil. One of the most important factors in the assimilation of lime is Vitamin D, which is abundantly present in milk, green food and cod liver oil, and which is believed to be formed in the body itself under the influence of ultra-violet rays, which are present in direct sunshine. The amount of calcium required in the ration is thus less when the ration contains foodstuffs rich in Vitamin D than when it consists of cereals and commercial by-products, which are relatively poor in this vitamin. It

is also less in the case of animals kept in the open than in animals kept continuously indoors.

Estimates have been made by various authorities of the amounts of lime and phosphorus required by animals. Thus one writer has estimated that a calf should receive $\frac{2}{3}$ oz. of calcium (as CaO) and 1 oz. of phosphorus (P_2O_5) per day, and another writer has estimated that a four-months-old pig should receive from $\frac{1}{3}$ to $\frac{1}{2}$ oz. of each of these per day. The requirements of dairy cows have been estimated at from two to four times the amount of calcium in the milk secreted.

In estimating the requirements of animals for the practical purpose of balancing up the ration by supplying whatever is deficient, the best and safest method is to take as the standard the milk of the species, or for cattle the composition of good pasture. We know that for young animals, so far as the minerals required in largest amount are concerned, milk contains these in the right proportions, and we also know that good pasture is an ideal food for milk cows, and therefore presumably well balanced in all its constituents. Indeed, as is shown below, the mineral composition of good pastures is somewhat similar to that of cow's milk.

The following table shows the amounts of calcium, phosphorus, sodium and chlorine contained in quantities of various representative foodstuffs of equal energy (starch) value.

TABLE 1

COMPARISON OF MINERAL CONTENT OF MILK AND GOOD PASTURE with SOME OTHER FOODSTUFFS

1,000 calories contain the following amounts in grammes

	Lime (CaO)	*Phosphorus* (P_2O_5)	*Sodium* (Na_2O)	*Chlorine* (Cl)
Cow's Milk	2·38	3·43	0·81	1·40
Good Mixed Pasture ..	3·64	2·75	0·94	3·50
Lucerne	8·31	2·30	2·39	2·00
Maize	0·03	1·83	0·13	0·001
Wheat	0·14	2·75	0·13	0·20
Wheat Offal	0·29	5·24	0·84	0·12
Potatoes	0·28	1·60	0·49	0·30
Turnips	1·18	1·96	0·33	0·42
Decorticated Cotton Cake	1·22	11·26	0·24	0·11
Molasses	4·68	0·79	0·90	3·13
Fish Meal*	39·6	32·4	5·4	7·2

* Very variable, especially with regard to chlorine.

It will be seen that good mixed pasture is relatively rich in all the four minerals and, like all green food, is very rich in calcium. Legumes such as lucerne are especially rich in this element. Roots and tubers are relatively poor in all the minerals. Concentrates, such as decorticated cotton cake and wheat offal, are usually very rich in phosphorus, but poor in calcium. Molasses and fish meal are of special interest. The former is rich in calcium on account of the fact that lime is added in the process of sugar manufacture, and fish meal is very rich in all the four minerals, and especially in calcium and phosphorus, on account of the fact that it is made very largely from fish bones.

Balancing up the Ration with Minerals.—Since foodstuffs vary so widely in their mineral content, it is obvious that some rations will contain an abundance of them all, and others be deficient in one or more. Hence, before deciding what minerals, if any, are needed for any given ration, it is necessary to find out how much of each is already present. In the adjustment which is now attempted by most reputable firms putting compound cakes and meals on the market, the amount already present in the meals is determined by analysis or by calculation from the known composition of the ingredients. These amounts are then compared with the amounts present in good pasture, if the ration be for milk cows, or in the milk of the species if it be for very young animals. The comparison shows which minerals are deficient and which are present in excess and a simple calculation gives the amounts of those deficient that need to be added. Ground limestone or chalk is used to supply calcium, bone meal to supply both calcium and phosphorus and common salt to supply sodium and chlorine. Other minerals, *e.g.*, iron if the ration is for young pigs, or iodine, may be added in small amounts, but these need not be considered here.

Very few farmers, however, would take the trouble to do these rather complicated calculations, even if they had all the necessary analytical data. It is not difficult, however, to make a rough and ready adjustment in cases where the ration is believed to be markedly deficient. Let us consider the general lines of such rough adjustments in the case of different farm animals. More detailed information can be obtained in easily accessible publications. A list of some of these is given at the end of this article.

Pigs.—The animals most liable to suffer from deficiency of minerals are (1) those just past the weaning stage, when the rate of growth in proportion to the size of the animal is greatest, and (2) pregnant and nursing sows which need a mineral-rich ration to provide material for the intra-uterine growth of the young and for milk secretion. Animals kept indoors are more liable to suffer from deficiencies than those with a run outside.

The latter have a chance of picking up grass or other mineral-rich substances, or of rooting, and have also the benefit of sunlight, which facilitates the assimilation of calcium—the mineral most liable to be deficient.

For ecomomic reasons, the greater part of the food of pigs consists of wheat offal and other cereal products with, frequently, the addition of potatoes. These are all deficient in calcium, sodium and chlorine. A growing pig would need to eat over 20 lb. of a mixture of equal parts of the cereals referred to in Table 1 to get the $\frac{1}{3}$ or $\frac{1}{2}$ oz. of calcium (CaO) it needs. Such a ration of cereals should be balanced up by the addition of a mineral mixture of $2\frac{1}{4}$ lb. of ground limestone and 2 lb. of common salt per 100 lb. of cereals. If there were any danger of a deficiency of phosphorus, as might occur if potatoes were to form a large part of the ration, it would be desirable to substitute bone meal for part of the ground limestone. Indeed, most mineral mixtures for pigs contain bone meal because it supplies both calcium and phosphorus.

A box with a mixture of coal and wood ashes is often put in the pens as an additional precaution against mineral deficiency. The ashes supply lime, iron, alkalies and traces of other minerals which are essential to health.

The figures given in Table 2 can be taken as an example of the effects of balancing up a cereal ration for pigs fed indoors and without any possible access to minerals other than those contained in the food. In this case, the minerals, instead of being mixed with the food, were supplied in a box put into the pen and the pigs were allowed to make their own adjustment according to instinct. This method, while simpler than mixing the minerals with the food, is wasteful, as a certain proportion gets spilt and lost.

Two groups of pigs were fed in adjoining pens on a cereal ration. One of the groups had access to a box containing chalk, bone meal, salt and ashes. The average gains were as follow:—

TABLE 2

	Initial Weight	*Weight after 124 days*	*Gain*
	lb.	*lb.*	*lb.*
Cereals alone	32·1	101·4	69·3
Cereals with mineral mixture	31·5	164·3	132·8

If, however, the ration in addition to cereals had contained some mineral-rich foodstuff such as fish meal, or meat and bone meal, the above mineral mixture would not have been necessary. Fish meal, up to 10 per cent. of the total ration,

would supply a sufficiency of all the essential minerals with the exception of iron. Meat and bone meal is of varying composition, depending on the amount of bone included: if it contains a good proportion of bone it would yield an ample supply of both calcium and phosphorus, but there might be a deficiency of sodium and chlorine which could be made good by an addition of common salt. Again, if the animals had an abundant supply of fresh green food such as they would get if they were grazing on good pasture, the green food, which is rich in the minerals deficient in the cereals, would help to balance up the ration and make a mineral mixture less necessary. The figures in Table 3, for an experiment carried out at Illinois with pigs grazing on good pasture, may be quoted for comparison with those given above for pigs fed indoors. Two groups of pigs were fed a ration of maize, linseed meal and middlings, with access to blue grass pasture, which is relatively rich in the minerals deficient in the meal ration. One lot were given access to a mineral mixture consisting of ground limestone, rock phosphate, salt and coal. The table shows the differences in the rate of gain and amounts of food consumed:—

TABLE 3

	Average daily gain	*Concentrates consumed per 100 lb. gain*
	lb.	lb.
Ration + grazing ..	·93	505
Ration + grazing + minerals ..	1·00	468

The animals receiving no mineral supplement rooted up the pasture completely, while the lot receiving the minerals did very little rooting. It will be noted that in this case, where the animals were outside and had plenty of green food and liberty to root, the effect of deficiency of minerals in the meal ration was less marked than in the case quoted in Table 2, where the animals were confined indoors without green food and without an opportunity to supplement their ration by rooting, and also without the beneficial effects of sunlight.

The difference between these two tests illustrates a very important principle which needs to be emphasized, viz., that the effect of a mineral mixture on any ration depends upon the extent to which it makes good a deficiency in the ration. In the first experiment there was a marked deficiency of calcium, sodium and chlorine, and consequently there was a distinct difference between the rate of growth of the animals on the deficient ration and those on the ration in which the mineral

deficiency had been made good. In the second experiment the addition of the green food and the rooting made good the greater part of the deficiency in the meal ration, and consequently the benefit of the mineral mixture was slight; the difference between the rates of growth of the group receiving minerals and those receiving none was within the limits of experimental error.

A great many experiments on the lines of those referred to above have been carried out at various experimental stations in this country and America, and there is general agreement in the results. These results seem to have a definite practical bearing on pig husbandry. In this country there are still farms on which young pigs are fed indoors on rations deficient in minerals, with a resulting slow rate of growth, poor condition, and the occasional appearance of rickets. Apart from the exact balancing up of the ration there are certain simple precautions which can be taken without any expert knowledge and without any great cost, and which, indeed, will do no harm even if the ration itself be balanced up. Boxes containing ground limestone, bone meal, common salt and ashes can be put in the pens or made accessible in the pig runs. In many cases young pigs can be allowed a run outside on pasture. If this is impossible some green food should be given. If green food be not available cod liver oil, say about a pint to a cwt. of food, should be given, especially in the winter months. This will assist the assimilation of calcium—the mineral which is usually most deficient in the ration of young pigs. Even a crude attempt to balance up the ration or to give the pig a chance to balance its own ration by these simple devices would in many cases lead to increased profits from greater growth and from keeping the pigs in better condition.

Cattle.—Young cattle are less liable to suffer from deficiency of minerals than are young pigs, because they do not grow so fast. A young pig doubles its weight in about 10 days, where a calf takes about 40 days. Further, the calf receives milk for a longer period after birth, and when weaned is usually given, in addition to a meal ration, either pasture or hay, both fairly well balanced in minerals. When, however, calves are weaned early on to a ration consisting chiefly of a mixture of cereal products, more rapid growth and better condition would be obtained in indoor feeding in winter by balancing up the ration by the addition of mineral salts and cod liver oil, on the same lines as has been suggested for young pigs. In summer, however, if the calves are running on good pasture, it has been

found, as in the case of pigs, that the balancing up of the meal ration has comparatively little effect.

In older cattle, say animals about three-quarters grown, provided they are getting good roughage, it has been found that the balancing up of the concentrated part of the ration with minerals has very little effect on the rate of growth, though in some cases it seems to keep them in rather better condition.

Grazing Cattle.—Good mixed pasture on land which has been cultivated and properly treated with fertilizers is the best balanced of all foodstuffs for cattle. It contains all the essential minerals in the right proportions. Natural grazing, however, may be deficient. Thus, in certain parts of South Africa, Australia and the United States, lack of phosphorus in the herbage may be so great as to be the cause of disease. In these districts the feeding of the appropriate mineral mixture is accompanied by increased rate of growth in young stock, and increased breeding capacity and higher milk yield in cows. Thus, in a test in South Africa, it was found that the feeding of 3 oz. of a mixture of bone meal, which supplied calcium and phosphorus, and common salt, which supplied sodium and chlorine, doubled the rate of growth of young stock, and increased the milk production of cows by about 40 per cent. compared with similar stock grazing on the same deficient pastures, but receiving no supplementary feeding.

In this country, so far as is known, there are no pastures so deficient in phosphorus as those referred to above. There are, however, rough grazings where the herbage is poor in minerals. In many cases the chief deficiency is calcium. Nevertheless, there has not been sufficient experimental work done to show whether or not the feeding of minerals to cattle grazing on those pastures would have a beneficial result sufficient to justify the cost or the trouble. Some experiments are being done with sheep. So far the results seem to indicate that, in areas where there is a very marked deficiency in the pastures, as in parts of the West Highlands, distinctly beneficial results are obtained by feeding small quantities of substances which roughly represent the difference between the composition of these poor pastures and good pastures. On the other hand, on moderately good pastures no definite effect has been obtained.

The whole question of the use of mineral mixtures or salt licks for animals grazing on poor pastures is only beginning to be investigated, and the striking results obtained in other countries cannot be applied direct in this country, because, not only are the deficiencies of a different nature, but the climate

and other conditions vary. The only practical suggestion which can safely be made is that rock salt should be supplied on the grazings. This costs little, and if it be put out on the grazings in a box, animals will lick it themselves if they need it.

Dairy Cows.—A cow giving 4 gallons of milk per day secretes daily in the milk 1·0 oz. calcium (CaO), 1·3 oz. phosphorus (P_2O_5), 0·4 oz. sodium (Na_2O), and 0·64 oz. chlorine (Cl). These are taken from the living tissues of the animal, and unless she can absorb from the intestine sufficient to replace this loss, the tissues become depleted. In most heavy milking cows there is, during lactation, a progressive depletion of the skeleton. It has been estimated that a cow may lose as much as 20 per cent. of the mineral matter of the skeleton during a lactation period. The writer has suggested elsewhere that this depletion of the tissues of heavy milking cows may be the cause not only of decreased milk yield in subsequent lactations, but of difficulties in breeding, and an increased susceptibility to disease.

The element which presents the most difficult problem is calcium. The fodder fed, especially if it includes good hay, will contain more calcium than is secreted in the milk. The concentrates, however, given in the production ration are likely to be poor in this element. Even if an abundance of calcium be provided in the food, however, there is difficulty in getting a sufficient amount absorbed from the intestine. The calcium in green food is more easily assimilated than the calcium in concentrates. It is also better assimilated from well got hay which has been little exposed to the elements after cutting than from hay which has been badly weathered.

There has been a number of short-period experiments to discover the effect on the milk yield of minerals fed to dairy cows. The results have been mostly negative. Short tests are of little value because, provided the ration be good enough in other respects, the cow will for a considerable time continue to give milk up to nearly her full capacity, even though her tissues are being depleted through lack of minerals. It is only when this depletion has reached a certain degree of severity that it affects the milk yield. Hence the effect of the mineral adjustment of the ration is to be sought not in an immediate increase in milk yield but in preventing or delaying the depletion which causes a reduction in yield. Indeed, the effect of depletion in one lactation period is not likely to be seen until the following lactation.

In one of the few experiments which have been carried on

for a series of years, little difference was found in milk yield the first year. Indeed, the cows on the balanced ration gave rather less milk than the others. In the second year there was a difference in favour of the "mineral" group, and this became more marked in the third year. Further, at the end of the third year all the cows on the balanced ration were in perfect health and condition; whereas in the other group only one cow was in good health. The following figures show the average milk yield in the three successive years.

YIELD IN LB.

	"Non-Mineral"	*Increase or Decrease*	*"Mineral"*	*Increase or Decrease*
1st Lactation	10,699	—	10,029	—
2nd Lactation	9,358	−1,341	10,229	+200
3rd Lactation	8,778	− 580	11,183	+954

The number of cows in this test (six in each group) was too small to give confidence in the result. There is great need for similar tests to be run with larger groups of cows over even longer periods than three years, because the effect of the depletion and therefore of the feeding of the minerals to prevent depletion is cumulative, and consequently the results would be more definite the longer the experiment was continued.

In this country depletion of minerals in milk cows is likely to be greatest in indoor feeding in winter. The following measures may be taken to reduce this depletion to a minimum. The productive part of the ration, which usually consists of cereals and commercial by-products, which are poor in calcium, sodium and chlorine, should be balanced up with limestone and common salt to make the total production ration roughly of the same chemical composition as milk or good pasture. The proportions of these would, of course, vary with different rations. A useful mixture would be 2 parts of limestone to 1 of salt. It is found that from 45–50 lb. of such a mixture are required per ton of concentrates. In addition to this it is wise to put up a salt block within reach of each cow, so that she can lick as she pleases, and so adjust at least the sodium and chlorine intake according to her instincts.

It should be remembered that if the ration contains fish meal, the addition of the above mineral mixture will be unnecessary, but if it contains meat and bone meal it may be necessary to add some limestone and common salt. It should also be noted that most commercial firms putting dairy cakes and dairy meals on the market include whatever minerals are necessary to balance the ration.

The fodder is, of course, also important. Mineral-rich fodder, such as well got hay, especially if it contains a high proportion of legumes like clover or lucerne, will go far to balance up a production ration of mineral-deficient concentrates.

Another practical measure of very great importance is the building up of reserves during the dry period. In balance experiments, in which the total intake and the total output of minerals from the cow's body are determined, it has been found that the loss is greatest at the height of lactation, and decreases towards the end. When the yield gets below a certain level, which varies according to the nature of the ration, the loss is usually replaced by a gain, which may be very rapid, during the dry period, if the ration be rich enough.

If at this stage the supply of concentrates is reduced, care should be taken that the proportion of minerals to concentrates is increased, so that a sufficient total intake of minerals is assured. The feeding of mineral-rich fodders is as important in the dry period as during lactation. It enables the cow to make good the depletion of the previous lactation and to build up reserves for the next.

Poultry.—The cereals and cereal products which form the major part of the ration of hens, while comparatively rich in phosphorus, are poor in calcium, sodium and chlorine. Laying fowls, therefore, must have a supply of lime in addition to that present in the foodstuffs. They usually obtain a supply from lime grit or oyster shell, which is provided *ad lib.* It has been found by extensive tests that, even in cases where lime grit or oyster shell is provided *ad lib.*, the egg yield is increased if the cereal ration be balanced up by the addition of a mineral mixture consisting of ground limestone, bone meal and common salt to the extent of 3–4 per cent. of the ration. If, on the other hand, the ration contains a high proportion of fish meal, a mineral mixture such as that suggested above is unnecessary, but if it contains meat and bone meal it may be advantageous to add some limestone or common salt, the amounts to be added being determined by the amount of bone present. It is unnecessary, however, to discuss here in detail the mineral requirements of poultry, as the results of several years' co-operative work between the Ministry of Agriculture for Northern Ireland and various centres in Scotland have recently been published. References to these publications are given at the end of this article.

Minerals Required in Traces : Iron and Iodine.—It is known that in addition to the minerals which are required in

relatively large amounts there are others which are essential to health, but which are needed in very small amounts only. Fortunately, most foodstuffs contain sufficient of these. As far as we know at present, the two which are of greatest practical importance are iron and iodine.

It is only in the case of young pigs fed on a diet of milk and certain commercial by-products which contain almost no iron salts that there is any danger of farm animals suffering from lack of iron. The best method of guarding against a deficiency is to give the sow and young pigs some green food, which is rich in iron. A run outside on pasture for young pigs can be arranged in most piggeries.

Iodine has recently received a great deal of attention both in Europe and America. This is due to the fact that in certain districts where goitre is endemic, owing, it is believed, to iodine deficiency in the vegetation, the occurrence of goitre in cattle and sheep and the birth of weak, hairless pigs has been prevented by the administration of potassium iodide. It is considered by some investigators that there are many districts in which, though deficiency of iodine in the herbage is not so great as to cause goitre, there is still insufficient present to maintain animals in perfect health, and that the administration of iodine under those conditions would lead to greater production and to a decrease in disease.

The results of tests seem to vary with the districts in which they are carried out. In some parts of Europe and the United States, the addition of small quantities of iodine to the ration is said to be followed by increased growth of young pigs and larger and healthier litters. Good effects in the case of brood sows have also been reported from a district in England. In the case of milk cows a German experimental station has reported increased milk yield of from 8–10 per cent. as a result of giving potassium iodide. On the other hand, in Aberdeenshire, where the vegetation is rich in iodine, no beneficial effect from potassium iodide has been found in the case of pigs or cattle allowed to graze, though in cattle kept indoors and fed mainly on imported foodstuffs the results of tests, so far as they go, seem to indicate that the administration of iodine keeps the animals in better health and condition. We must await the results of feeding experiments in different districts with large groups of animals over periods of three or four years before we can state with certainty the effects of the administration of iodine outside the well-known goitre areas.

In the present state of our knowledge it seems advisable in

winter feeding to add a little potassium iodide to the ration, to the extent of about ½ oz. per ton of the concentrates. It is most probable that in some districts where there is a sufficiency of iodine in the pastures and crops the additional iodine will have little or no effect. In other districts, however, where the percentage of iodine in the herbage is low, the additional iodine may have a beneficial effect.

There is difficulty in mixing ½ oz. with a ton. The method adopted where other minerals are being added is to mix the iodine with the other minerals and then mix them in turn with the concentrates. If no other minerals are being added the potassium iodide may be mixed first with a small amount of some foodstuff of different colour from the rest, and then this foodstuff can be mixed with the whole.

Summary.—We have seen that certain mineral deficiencies are liable to occur in intensive feeding. In earlier experiments to correct these deficiencies complex mixtures were used containing everything that might be thought to be lacking. As our knowledge has increased, the tendency has been towards simpler mixtures. Indeed, ground limestone, common salt, bone meal and, in goitre districts, very small amounts of potassium iodide will make good the main mineral deficiencies in any ordinary ration. If the ration contains a high proportion of cereal offal, and consequently has a high phosphorus content, ground limestone and salt may be all that is required. If the ration is low in phosphorus, the addition of bone meal, to replace part of the ground limestone, will preserve the balance. These substances can be procured easily by the farmer, and the methods of use have been indicated.

In conclusion, it is desired again to emphasize the fact that the beneficial effects of vitamins or minerals added to any given ration, or for any given class of farm stock, can be tested by stockmen themselves. The interest in the tests will repay the little extra work, and the results may give information which, in later application, will yield material benefit. Such tests should be carried over long periods, *e.g.* at least three years in the case of milk cows, because the evil effects of deficiencies and the beneficial effects of balanced rations tend to be cumulative.

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CAULIFLOWERS FOR PICKLING

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THE cauliflowers used by English pickle manufacturers come mostly from the Continent, this imported product being preferred by them as more suitable for the purpose than the home-grown article. An investigation was started at this Station in 1925 to ascertain what varieties were grown on the Continent and imported into this country for pickle manufacture; and an account of the trials of various varieties then carried out was published in the issue of this *Journal* for November, 1926. As a result of those trials, it was stated that the variety "Danish Giant" had been found to meet all the requirements of the pickle makers; and there seems no doubt that the imported article consists mainly of this variety.

Trials were continued in subsequent years (1) to confirm or modify the results obtained in 1925; (2) to obtain further information regarding varieties and stocks of varieties; (3) to ascertain the optimum spacing for "Danish Giant";

(4) to find ways and means of counteracting the tendency of "Danish Giant" and similar varieties to "button"; and (5) to obtain information regarding the marketing of the crop.

As to (1), the indication of the 1925 trials, that "Danish Giant" was the type required by the manufacturer, was definitely confirmed by further trials in 1926. Subsequent variety trials have, therefore, been confined chiefly to stocks of "Danish Giant," although a few other varieties not previously investigated have been included.

(2) The trials have also shown that strain within the variety is of great importance. Not only are there good and bad strains of "Danish Giant," but strains from the same source may vary year by year. Success or failure may depend entirely upon the stock or strain obtained.

(3) Conditions during the past two years have not been favourable, so that a complete plant was not obtained on all the trial plots, and the recording of weights from the various spacings could not be carried out. As a result, however, of observation and experience in the growing of the crop, it can be stated that the varieties recommended as suitable for pickling, being all comparatively small, can be successfully grown in narrow rows, with close spacing of the plants in the rows. A spacing of 1 ft. 6 in. between rows and 1 ft. between plants will produce a heavy crop. Medium-sized heads are usually of better quality than large heads, and they can be produced at the spacing mentioned.

(4) "Danish Giant" and varieties of a similar type have a tendency to "button," *i.e.*, to form a very small head or flower when the plants are quite small. This may be due to the plants being left too long in the seed bed, or to the prevalence of very dry conditions after setting out. The tendency to "button" appears to be a characteristic with certain strains of "Danish Giant"; with others, it seldom appears. To prevent "buttoning," the following precautions are necessary: (1) transplanting from the seed bed at the correct stage; (2) ensuring that the soil in the permanent quarters is in good tilth, with plenty of humus; and (3) planting under moist conditions.

In the Holland Division of Lincolnshire, it is customary to take a cauliflower crop after spring cabbage or early potatoes. After spring cabbage, the land is often in a very dry state, and it is difficult to secure a proper tilth. Where the crop is grown after potatoes, there is frequently a slight delay before planting out. As "Danish Giant" must not be left in the seed bed beyond the correct stage for transplanting, it would seem desirable, if the crop is to follow early potatoes, to adjust the date of sowing so that there is not likely to be any delay when the plants are ready for setting out.

(5) Investigation into the marketing of pickling cauliflowers has not been fully completed, but certain points of interest have already emerged. The best price and the surest market are secured by contracting with the pickle manufacturers. The heads should be cut when at their best, and, as the period of cropping extends over some little time, it is desirable to grow an acreage sufficient to provide a consignment at each cutting; or, alternatively, to place the heads in brine, so that they may be forwarded at leisure. If the latter method is adopted, the acreage will not matter, as the crop may be gone over daily if need be.

Before packing or brining, the heads should be stripped of all leaves, as shown in Fig. 1, this being required by the pickle makers. It is not feasible to load these cauliflowers loose in trucks, as is sometimes done with the ordinary market product. Suitable empties, such as barrels, are often obtainable from the pickle firms; but packing in non-returnable crates would probably be the easiest method for the average farmer to adopt, provided that he had sufficient acreage to furnish a sufficient consignment at each cutting. Crates were used at this Station and proved quite satisfactory, the type used being shown in Fig. 2. The dimensions of this crate are 2 ft. by 1 ft. 6 in. by 11 in., outside measurements, and it holds ½ cwt. when properly packed. The cost for the small number of crates required worked out at 7d. each, but no doubt both crate and price could be improved if there was a demand for them.

Packed specimen crates of these cauliflowers were sent off to pickle firms in various parts of the country, and, with one exception (when the crate was damaged), were reported to have arrived in good condition. These crates necessarily travelled singly and received a good deal of handling, whereas a consignment of any size would be packed in the truck at the loading station, and remain undisturbed until it reached its destination.

A. The following tables serve to show variations in individual stocks of "Danish Giant":—

YEAR 1926.

Stocks.	*Percentage of Buttoning.*	*Date of Cropping.*	*Remarks.*
Danish Giant 1	30	Mid- to end September	
" " 1a	1	Mid- to end September	Same source as No. 1. Smaller growth.
" " 2	75	Early September	Three types in this stock—good quality.

Stocks.	Percentage of Buttoning.	Date of Cropping.	Remarks.
Danish Giant	3 80	Early September	Good quality.
,, ,,	4 10	Early September	Very good stock—distinct from 1, 2 and 3.
,, ,,	5 1	Late September	Good. Loses quality when very large.
YEAR 1927.			
Danish Giant	1* 1	(a) Early to Mid-September. (b) Mid- to late September.	Two types in this stock.
,, ,,	2 50	Mid-September	Bad stock. Later than in 1926.
,, ,,	3 10	Mid- to end September	Excellent stock.
,, ,,	4 (a) 10	Early September.	Two types in one stock—neither same as in 1926.
,, ,,	4 (b) 30	Mid- to end September.	
,, ,,	5	No seed obtainable in 1927.	Only fair quality.
YEAR 1928.			
Danish Giant	1† 50	Mid-September.	Good.
,, ,,	2 10		Useless stock.
,, ,,	3 15	Mid-September.	Very good stock.
,, ,,	4 17	Mid-September.	Variable stock.
,, ,,	5 10	Early October.	Not good stock.

*Numbers represent same seedsmen as in 1926.
†Numbers represent same seedsmen as in 1926 and 1927.

B. The following tables show variations between stocks received in successive years from the same source.

SEEDSMAN No. 1.

Year.	Description.	Maturity.	Remarks.
1926	Small to medium growth. Spreading habit.	Early September.	Very good.
1927	(a) Medium growth.	Early September.	Good (Two distinct types. Neither similar to the 1926 stock.)
	(b) Dwarf growth.	Mid- to end September.	Good
1928	Variable.	Mid-September.	Good.
SEEDSMAN No. 2.			
1927	Small medium growth.	Mid-September.	Very good, and well covered.
1928	Medium growth. Spreading.	Mid-September.	Quite distinct from the 1927 stock, and not nearly as good.

The examples given above are extracted from the records of the experiments, and serve to show what happened throughout the whole of the trials.

Notes on Certain other Varieties.

Early Dwarf Erfurt.—This variety is similar in habit to Danish Giant. Of the stocks tested, only one (in 1928) was equal to Danish Giant. This stock was not quite the same type as the other stocks of Dwarf

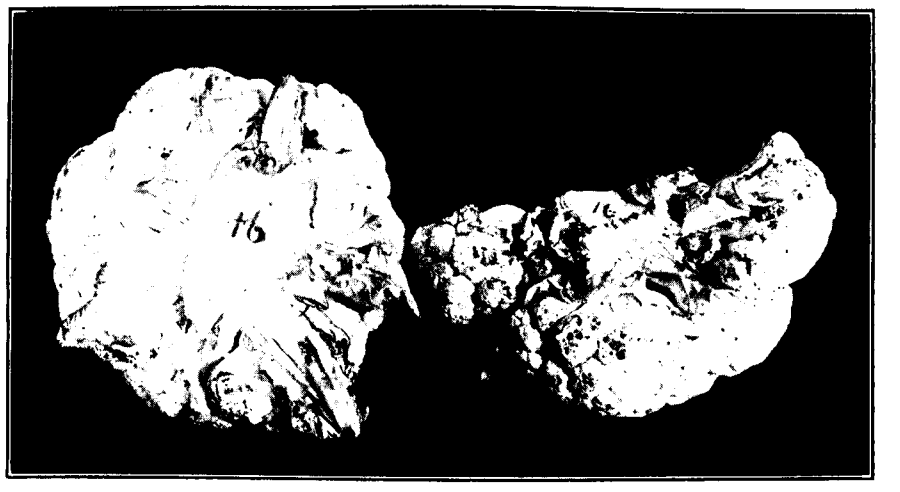

Fig. 1.

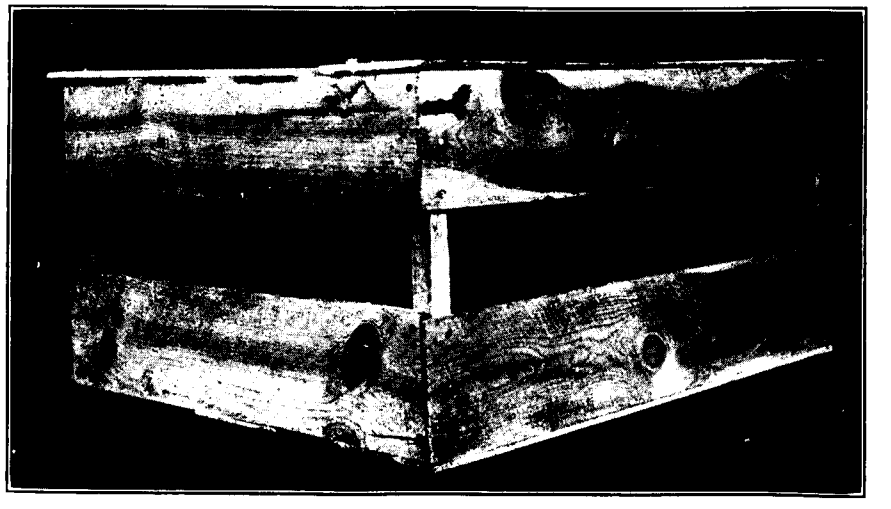

Fig. 2.

Cauliflowers for Pickling.

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Erfurt. The stocks of Dwarf Erfurt were irregular in cropping, one coming in at the end of August, others in September, and two early in October.

Erfurt Forcing.—This variety was favourably reported on in 1925. Stocks obtained in 1926 and 1927 from the same source as the 1925 stock proved quite useless. None of the other stocks tested in 1926, 1927 or 1928 proved of value.

Early Erfurt Mammoth.—Stocks of this variety were extremely variable. Only in one case did the quality come up to Danish Giant.

Delf Short Stem.—Fair in 1926; good in 1927 and 1928.

Danish Export.—Sent in by two firms. Very good. Very similar to Danish Giant.

Enkhuizen (1926 and 1927), *Reliance* (1926), *Perfection of Massy* (1926), *Ameliore d'Orgeval* (1926), *Demi'dur de Paris* (1926), *Extra Early Paris*, *All the Year Round* (1926–7–8), *Early Algiers* (1926), *Algiers Giant* (1926), *Early Naples* (1926), *White Queen*, and *Magnum Bonum* all proved quite useless for pickling purposes in the years in which they were tested.

Purity, *Universal* and *Express* were of Erfurt type, but not equal to Danish Giant.

General Summary and Recommendations.—Pickling cauliflowers can be grown in England of a quality equal to, if not better than, the Continental product.

Pickle manufacturers are prepared to purchase home-grown cauliflowers provided their requirements are met.

The ordinary varieties grown for market are useless for pickling.

The best variety is Danish Giant.

Stocks of this variety are very variable. Seed from the same source cannot always be relied upon year by year. One or two seedsmen have true stocks of this variety. Very few seedsmen stock the variety at present.

Danish Giant "buttons" easily. Plants must not be kept too long in the seed bed, and should be planted out in rich, moist soil.

Fixed contracts can be obtained from pickle manufacturers.

* * * * * *

SHEEP SHEARING

JOHN S. FEATHERSTONE,
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Preparatory Work and Care of Plant.—Preparation of the sheep, and care and maintenance of the machinery, are important items when large flocks are to be shorn. The former begins some time before the actual shearing by "dagging" or "belting"—the removal of dung and stained wool from the hindquarters. It is advisable to carry out this work as early as possible, because if the sheep are well cleaned in the spring before the hot weather, there is less smell to attract the fly at shearing time in May and June. The work is done with hand-shears that have short blades and a strong bow or spring. After it is completed, the sheep are sometimes washed (Fig. 1). This practice has gone out of favour very much of late, as flockmasters claim that it does not pay to wash when the price of wool is low. Sheep-washing, however, is still done in some districts, and it deserves to be added that, as far as the actual shearing is concerned, the washed sheep can be shorn more easily and quickly, and the quality of work is superior.

If it is the intention to wash, care should be taken with nursing ewes not to carry out the work while east winds prevail. The sheep should be fasted, and care taken in driving to and from the wash-pit. It is important to have plenty of clean water, preferably a running stream, so that grit and sand can be removed from the back. Shearing is done about 10 days after washing, allowing time for drying and for the grease to rise.

If a large flock is to be shorn, considerable time can be saved by care with the erection of pens. It is a good policy to erect a large one to hold the bulk of the flock, with a small one adjoining for the purpose of catching. This prevents running the sheep about, and saves time. Both pens should be fitted with gates which enable the shearer to enter and withdraw the sheep with ease and without loss of time. Flakes or hurdles can be used to make the pens, but these are of little use for the exit, being difficult to handle by those engaged in drawing out the sheep. Small gates speed up the work, and can easily be fitted. It is important to keep the pens clean; if litter is used, bracken, nettles, or coarse grass will be found more suitable than straw or other dried material, as they do not adhere to the wool so readily.

A clean, level site should be chosen for the shearing floor, and a sheet or old canvas should be pegged down on which

to carry out the work. In some districts shearers prefer to work upon a platform raised about 12 in. from the ground. Either plan prevents grass and other matter getting rolled up with the wool; any vegetable matter in the fleece is detrimental and should be avoided.

Care of Shearing Machinery.—The care and maintenance of the machinery used are of great importance, because unless it is in perfect condition the quality and quantity of the work will suffer. Good, clean shearer oil should be used for all working parts. The hand piece is lubricated by half-filing through the oil screw in the handle, and the blades may be lubricated by dipping the shear while in motion into an open tin containing about half a pint of oil. Care must be taken in lubricating friction-driven units, as no oil must get in contact with the clutches or friction pulleys. This will cause them to slip and give an uneven drive.

The blades are known as the comb and cutter; the former is fitted to the handpiece by the means of two screws, and remains stationary. The cutter has three or four points or knives, and is fitted over the comb and attached to the centre fork, which gives it a reciprocating movement. Extra wide combs and cutters may be used with the ordinary hand-piece on power-driven machines by fitting a special centre fork in place of the ordinary one. This allows of a wider breadth or stroke, and much quicker shearing, at very little extra cost. Combs and cutters are sharpened on a machine consisting of a circular disc to which a piece of emery cloth is attached. Unless a power machine is in use for this purpose, it is advisable to have them sharpened by the makers, who run a plant for the purpose, and usually send them back in good condition by return of post. When a number of blades have been sharpened, it is advisable to remove all emery dust by washing them in a tin containing paraffin, and then steeping them in oil. Emery dust left on the blades tends to dull them quickly.

It is important to see that the cutters fit perfectly to the centre fork, or a clean cut cannot be expected. Undue wear in this case will cause the blades to drag. When fresh blades are fitted, the tension should be screwed down only sufficiently to ensure a clean cut. As long as the blades continue to work satisfactorily, the tension nut should not be moved. If, however, the blades do not work well after a few sheep have been shorn, a little more tension can be given. It is well to observe that the lighter the tension on fresh sharp blades, the more sheep they will shear. If the tension is too severe a

first, blades heat, quickly become dull and must be replaced. They are removed and fitted by first loosening the screws under the comb, and then the tension screw. Care should be taken to keep sharp and dull blades separate.

The centre fork pins are subject to wear, and must be renewed when the cutters do not fit. The fulcrum cup, or bearing on which the centre fork works, must be a good fit. A worn fulcrum cup or worn fork pins will cause the machine to blur and drag. Should the blades heat, clog or "gum" (common on dirty sheep), they must be cleaned and oiled. If the blades are gummed when a sheep is finished, it is advisable to clean them at once before the gum and sand bake, or cleaning will be found difficult.

A final word with regard to machines and their management. Only the best lubricant should be used, in small quantities and often; there must be correct tension on the blades; combs and cutters should be sharp; worn parts must be renewed; all nuts and bolts must be tight, and the machine and blades, if stored, should be cleaned and greased to prevent rust. The only way to successful and speedy shearing is to keep the curve near the points of the comb pressed lightly on a taut skin, and to operate the hand piece with long steady strokes, using the full width of the blade or shear.

Points to be Observed.—To become efficient in the art of sheep shearing, it is important that the shearer should adopt a method by which the wool can be removed quickly, and at the same time leave an even, well-finished job. Well-shorn sheep always attract a good deal of attention in the market, and this tends to improve their value.

It is important, when being sheared, that the animal should be held in a firm, comfortable position, and in such a manner that the portion being shorn is well exposed, with a taut skin, to prevent cutting of the flesh. As a rule, the work is considered to be rather laborious, but this is much reduced by holding the animal in the correct way. If the sheep is comfortable, feels itself in a firm grip, and is moved about with care when changing positions, it will generally remain quiet; kicking or struggling causes more waste of energy than the actual shearing, and should be avoided as far as possible.

A level surface should be chosen for the shearing floor; this prevents the weight of the animal's body pulling the wool, as would be the case on an uneven floor—another cause of kicking. A level surface gives the shearer a much better foothold, which is very helpful should the animal put up a

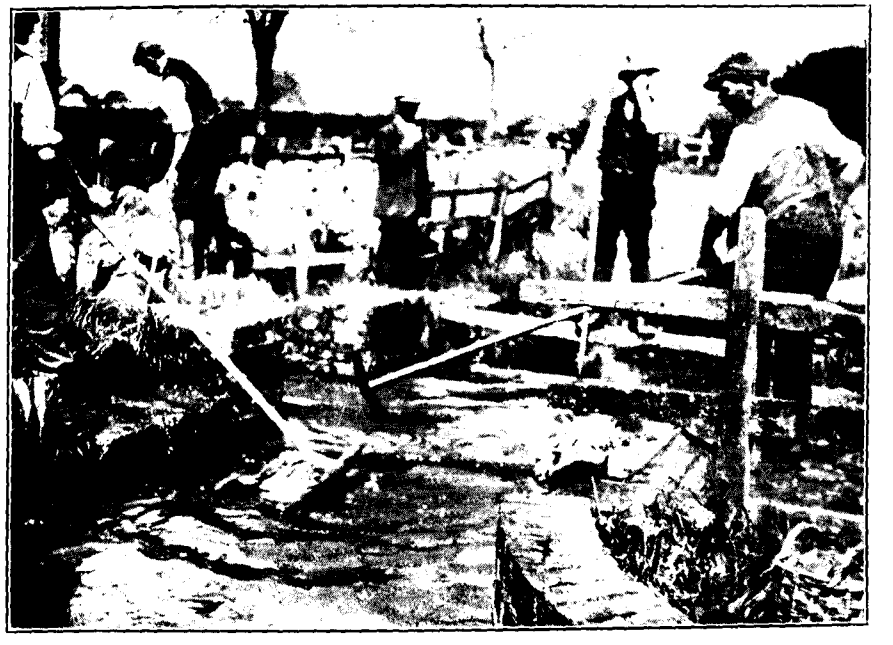

FIG. 1. Sheep washing in Nottinghamshire, preparatory to shearing.

FIG. 2. Showing the start.

SHEEP SHEARING: BY MACHINE.

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Fig. 3. Removing wool from the Leffy.

Fig. 4. Shearing the lower part of the throat.

Fig. 5. Shearing upper part of throat and neck.

Fig. 6. Shearing the hindquarters.

FIG. 7.—Showing the position of the shearer's legs.

FIG. 8.—Left hand work on offside.

MACHINE SHEARING.

FIG. 9. The start: left hand opening on the offside of the neck.

FIG. 10.—Right hand work across the throat and breast.

HAND SHEARING.

Fig. 12.—Right hand across off half of the belly.

Fig. 11.—Left hand work on offside. Note crescent-shaped stroke.

Fig. 13. The start of the near side with the right hand.

FIG. 14.—Half way down near side. Right hand work.

FIG. 15.—The finish.

struggle. When changing positions it is advisable to use the weight of the animal's body as assistance, by rolling it or by allowing it to slide gently into position: it should never be startled by letting it drop or by jerking it suddenly from one position to another, because this will often cause it to struggle, and thus cause loss of time and energy.

The method of shearing varies somewhat owing to the climate, conditions and custom of the district. In the north, a considerable "stubble" is left to protect the animal from the cold nights and late frosts. In other districts it is the policy to shear as close to the skin as possible, all strokes running crosswise from the belly to the backbone. In certain parts in the south, the fore-part of the animal is shorn crosswise and the hindquarters lengthways.

Machine Shearing.—The sheep is drawn from the pen by grasping the near hind leg above the hock with the right hand, or by the use of the crook. The latter is not recommended when shearing fat sheep for the butcher, as the hock is sometimes bruised slightly. By lifting the leg from the ground the animal can be steered out to the shearing floor. Another method is to grasp the wool near the flank with the right hand and at the neck with the left hand. The sheep is cast by holding the nose with the left hand, fingers under the jaw and thumb over the nose. The near hind leg is raised and pushed toward the breast with the right hand, and at the same time the head is turned to the offside toward the tail. This will force the animal to sit down on the near thigh. It is then rolled into position as shown in Fig. 2, sitting between the shearer's legs. It is advisable when using flexible cable machines to have them situated on the right-hand side. Machines fitted with tubular shafts work more freely when placed towards the front of the shearer. The first stroke is made at the open space under the fore leg, with a few strokes running towards the belly until the flank is reached. From this point a couple of strokes are made along the off thigh and to the foot if necessary. The next move is to bring the shearer's right leg forward, and with it hold back the wool at the opening. Then shear up the breast and across the belly, as shown in Fig. 3. The animal's fore legs are held in the left armpit. The wool is removed down to, and between, the hind legs. When doing this portion it is advisable to step back slightly and allow the animal to lie back, so that it can be reached with comfort. Fig. 4 shows the position, with the animal resting upon the shearer's legs and the head between his

knees, for shearing the lower part of the throat, working up with strokes from the right to the left. The wool is gathered out of the way with the left hand, after being severed by the blades. It is very important to refrain from pulling the wool, as this causes the flesh to be cut.

The next move and hold is shown in Fig. 5; in this position the animal rests upon the shearer's left leg, his left knee between the shoulder blades at the back of the neck, and it is gripped with the right knee between the breast and the offside foreleg. The right foot is placed at the back of sheep's off thigh. The strokes run from the part of the neck or throat unshorn to the offside ear, around the jaws and throat, the sheep's head being drawn over the shearer's left thigh to tighten the skin on the throat. When the wool is removed from throat, head and jaws, the strokes are continued as shown in Fig. 5, down the near side of the sheep. When the shoulders are bared, the sheep's foreleg is released, and by stepping back slowly it is allowed to slide gently down the outside of the shearer's left leg. The thigh is then reached, and at this stage it is allowed to lie on the off side as shown in Fig. 5, until the wool is removed from the hindquarters. The exact method of holding is shown in Figs. 6 and 7. The left foot is placed near the throat, with the sheep's head set back to prevent it gaining control of its fore-legs and so be able to rise. The shearer's left knee is near the centre of the animal's back, and his right leg is placed over and at the back of the near hock, with the right foot under the sheep's lower thigh. When in this position, the hindquarters, which can be conveniently reached, are shorn as shown. The wool is gathered from under the lower thigh, and the position is changed as shown in Fig. 8. It is considered important to meet the wool, or shear with strokes towards the backbone, therefore, on the off side, the work is done with the left hand, and by the time the flank is reached, with this method of holding and shearing, the work is finished.

The method explained and illustrated is one that is used extensively in the Midlands for machine shearing. It has often been demonstrated, and has met with much approval, because each hold and movement easily leads up to the next. The skin is always right on the portion being shorn, the animal is dealt with in a most humane fashion, seldom struggles, because it is held in comfort, and never for one moment feels itself free. The method once acquired, it is very easy for the shearer, and very speedy.

Hand Shearing.—Hand shearing, the old method of removing he fleece, is still in use in some districts. It is often practised n small farms where only a few sheep are kept, and on farms here skilled shearers are available. Good quality hand hearing requires considerably more skill than machine work, nd is more interesting once the operator becomes efficient. Iuch depends upon being able to whet the shears and hold he animal. Again, the style and method vary according to he custom of the district. The shears must be sharp to nsure an even cut and regular stroke. They may be first round on the grindstone, and the finished edge made by the se of a smooth whetstone or fine carborundum. Even new hears require this treatment before they can be used with uccess. In the Midlands it is considered correct to shear vith strokes running from the belly to the backbone. Half he work is done with the left hand, and the remainder with he right.

Fig. 9 shows the position for the start, the wool being emoved round the off ear and down to the shoulder. The nimal is then raised to the position shown in Fig. 10, all vool being removed from the throat and breast. A new osition (Fig. 11) is then acquired, and the wool is removed rom the offside with the left hand, a crescent-shaped stroke unning from the side to the backbone being used. Sometimes he wool is parted down the backbone to ensure the strokes neeting at this point. Fig. 12 shows the wool being shorn rom the off-side half of the belly, with the right hand. When his is done as far as, and between, the hind legs, the remainder s shorn from the back with the left hand, until the tail and ind quarters are finished. At this stage the animal is allowed o lie on its side. The near side is held, and shorn in the same manner, except that the remaining half of the belly is shorn with the left hand and the wool from the near side is done with the right hand (Figs. 13 and 14). When the shearing is completed (Fig. 15) the fleece is rolled and tied up. This operation is fairly simple. All stained wool and dirt should be clipped out and a clean unbroken portion chosen for the final wrap of the bundle. The latter can usually be found in the portion taken from the flank and side. If the fleece has been parted, both pieces are placed together, one on the top of the other, clean side down on a clean sheet or board. Turn in the ragged ends and sides, then roll into a compact bundle and tie with a thin band of wool.

MARKETING NOTES

National Mark Eggs.—The flush season for eggs is at its height in the spring months, and large quantities are now being marketed under the National Mark. During the month of March there passed through authorized packing stations approximately 22 million eggs, of which about 15½ millions were packed under National Mark labels. This quantity increased as the season advanced and as wider channels of distribution opened for National Mark eggs through the newly formed organization, National Mark Egg Central, Ltd. As reported in the April issue of this JOURNAL, this organization is an association of authorized egg packers, and is acting as a central selling agency for the marketing of packers' supplies through accredited agents appointed for the purpose. Although selling operations only commenced on March 10, over 5,000 cases had passed through the agents' hands by the end of that month, and a number of packers have expressed their satisfaction with the result thereby achieved. The accredited agents in London who have hitherto traded mainly in imported supplies are evincing keen interest in the scheme and anticipate big developments. It is noteworthy that during the recent depression in the egg market, National Mark eggs maintained relatively good prices.

Apart from the achievement of placing on the market large quantities of home-produced eggs graded and packed to national standards, the National Mark Scheme has undoubtedly had a marked influence upon the egg industry in general. The condition in which supplies are delivered by producers to packing stations has improved greatly during the past year, especially as regards cleanliness, "bloom" and quality. The last, which is always fairly reliable in the spring, has reached a high standard this year, whilst the proportion of brown eggs, so favoured by the consumer, is steadily increasing. These improvements are most noticeable at centres where payment for supplies is made on a grade basis, a practice in which producers now have greater confidence. Further, the value of the individual-egg-weight principle is now widely recognized, while the more general adoption of the practice of candling has enlightened producers as to the quality of their supplies, and has been an important influence in raising the quality standard generally.

It is interesting to note that there has been a decided increase in the use of cartons holding 1 dozen and ½ dozen National Mark eggs. This method of packing, which carries

right through to the consumer the guarantee of quality indicated by the National Mark label (which must be broken to open the carton), is strongly advocated by the Ministry. In the early stages of the scheme, it was found difficult, in many cases, to persuade consumers to purchase eggs in sealed cartons without prior inspection, and it is significant that this trade is now developing. To quote one instance, an important dairy firm in the Midlands now supplies cartons, printed with their own advertising matter, to the authorized packers from whom they obtain supplies. The cartons are filled by the packer and returned to the dairymen for retail distribution. The dairy company's preference for the cartons is explained by the fact that :—

(1) their roundsmen are saved time as compared with that spent in the delivery of loose eggs ;
(2) breakages, with consequential disputes, as between the roundsmen and their employers, are largely obviated ;
(3) the company are able to keep a better check upon the distribution of their supplies ; and
(4) the cartons are a valuable advertising medium, inasmuch as the distributor's name is associated with the quality of the National Mark produce.

The new grade designations for home-produced eggs, as reported in this JOURNAL for March, 1930, have now been in operation for some weeks and appear to meet the requirements of the trade. The statutory grade designations, as promulgated, are as follows :—

Hen Eggs	*Minimum Egg Weight*
Special Weight *or* Special	2¼ oz.
Standard Weight *or* Standard	2 oz.
Medium Weight *or* Medium	1¾ oz.
Pullet Weight *or* Pullet	1½ oz.

A satisfactory demand is already reported for National Mark eggs of the new Pullet Weight grade, but these, as well as Medium Weight eggs, have been in somewhat short supply, as is to be expected at this season of the year.

National Mark Beef.—The number of sides of beef graded and marked with the National Mark each week since the week ended March 8, 1930, has been as follows :—

Week ended	*Select*	*Prime*	*Good*	*Total sides graded and marked (Quarters and pieces omitted)*
		London		
March 15	973	856	104	1,933
,, 22	967	1,047	110	2,124
,, 29	1,128	1,005	60	2,193
April 5	**958**	**888**	**109**	**1,955**

Week ended	Select	Prime	Good	Total sides graded and marked (Quarters and pieces omitted)
		*Birkenhead**		
March 15	4	140	12	156
,, 22	—	156	4	160
,, 29	20	107	14	141
April 5	2	115	10	127
		*Scotland**		
March 15	1,933	315	..	2,248
,, 22	2,116	227	..	2,343
,, 29	2,170	313	..	2,483
April 5	2,122	291	..	2,413
		TOTAL LONDON SUPPLIES (All Sources)		
March 15	2,910	1,311	116	4,337
,, 22	3,083	1,430	114	4,627
,, 29	3,318	1,425	74	4,817
April 5	3,082	1,294	119	4,495
		BIRMINGHAM		
March 15	113	357	38	508
,, 22	123	384	14	521
,, 29	112	403	29	544
April 5	113	345	15	473

* Sides consigned to London.

The number of shops on the roll of meat traders for the London area on April 1 was 1,220. On the recommendation of the London Trade Advisory Committee, it was decided that, as from March 7, no sides, quarters or pieces should be graded in London or Birkenhead without also being marked with the National Mark. The result of this decision was a sharp increase in the number of sides graded and marked each week. The scheme is well established in London. There is a growing appreciation of the scheme on the part of the public in Birmingham, where the quantity of beef graded and marked shows a satisfactory increase during March.

It is interesting to note from the figures that the percentage of "Select" and "Prime" grade cattle during the Norfolk season has considerably increased, which is, no doubt, largely due to the general high level of supplies from this source; a contributory cause is the preference which London butchers are now showing for "Select" or "Prime" grades, a preference which is reflected in the widening of the price margin. It is also noteworthy that English beef of superior grades is now nearer in price to Scotch-killed beef than has been the case at any time since the National Mark beef scheme commenced.

The Minister of Agriculture and Fisheries and the Secretary of State for Scotland have jointly appointed a Committee to review the progress made by the English and Scottish schemes for grading and marking beef according to the regulations

made under the Agricultural Produce (Grading and Marking) Act, 1928, and to make recommendations in relation to the future extension and administration of these schemes. The Committee is composed of Lord Henry Cavendish Bentinck (Chairman), Mr. George Dallas, M.P., and Sir Archibald Sinclair, Bt., C.M.G., M.P. Communications should be addressed to the Secretary of the Committee, Mr. J. H. Gorvin, C.B.E., Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

National Mark Wheat Flour.—The Wheat Flour Scheme continues to make steady progress. Additional applications to be enrolled as authorized millers or packers are being received at the rate of about 10 per month, the number of firms on the roll now being 180. Sales of National Mark flour continue to increase, the demand for "Yeoman" being particularly good where this grade is used for bread-making. One London baker reports that he is now making 2,000 loaves per week entirely from National Mark (Yeoman) flour.

At the suggestion of the National Mark Wheat Flour Trade Committee, the Ministry has arranged for an investigation to be made at the National Bakery School, Borough Polytechnic Institute, into the technique required in the use of National Mark flour of the All-English (Plain) and All-English (Yeoman) grades for bread-making. This investigation should provide useful information for the guidance of bakers in dealing with All-English flour of the current season's milling.

At the forthcoming Confectioners', Bakers' and Allied Traders' Exhibition, to be held at the Agricultural Hall, Islington, from September 6-12, the Ministry is offering three prizes, totalling £18, for the best All-English Commercial Milk Loaf made from National Mark flour. Competitors will be required to give a guarantee that the loaf is made wholly from All-English National Mark flour and fresh liquid milk, or its equivalent of English-made milk powder or condensed milk.

The National Farmers' Union is also offering a prize, to the value of £21, for the best Commercial Tin Loaf of plain bread made entirely from All-English National Mark flour. To this offer, the Ministry will add a second prize of £10 10s. and a third prize of £5 5s.

National Mark Strawberries.—The strawberry scheme, which is due to be inaugurated shortly, has received the approval of the National Farmers' Union and the trade organizations concerned. Investigations have shown that many more

growers are in the habit of grading their crops for market than is generally believed. These growers will have little difficulty in complying with the requirements of the scheme, and have shown encouraging interest in the proposals.

National Mark Tomatoes and Cucumbers.—Slight amendments to this scheme have been made as the result of last season's experience, and by the addition of a new weight range—viz., 3-6 fruits to 1 lb.—a larger grade of tomatoes may now be packed under the National Mark. Other amendments include the compulsory use of new non-returnable packages, whilst the tolerance previously allowed in respect of the weight range has been abolished. Growers who participated in the scheme last season have expressed their satisfaction with the results, and are anxious to continue operations under the National Mark. The number of growers authorized is increasing, and there is every indication that the scheme is now fairly established.

Displays of Home Produce.—During the month of April, home produce was displayed at the Portsmouth Grocers' Exhibition and the Manchester Grocers' Exhibition. Advantage was also taken of an offer from the proprietor of one of the largest stores in Sheffield to arrange a working demonstration of packing National Mark eggs.

An exhibit of National Mark beef was arranged at the Birmingham Hippodrome.

An Experiment in the Marketing of Cattle.—In the Ministry's Report on the Marketing of Cattle and Beef in England and Wales (Economic Series No. 20), it was suggested (p. 87) that, if the meat grading and marking system became generally adopted, it might be possible to effect sales on the hoof direct from the farm to the abattoir by "purchase outright according to grade, at a price previously arranged." The general adoption of the grading and marking system throughout the London trade made it possible to carry out an experiment in marketing cattle on this system, and the following results were obtained.

A Norfolk farmer offered to send up a truck load of high quality cattle to London if the wholesale trade could quote a price which would be satisfactory to him. The basis of the quotation was to be the dead weight stone, and the Ministry's graders were to certify the grade and weight of the carcasses.

Two London wholesalers quoted independently 6s. 8d. per 8-lb. stone dead weight for "Select," 6s. 6d. for "Prime" and 6s. 4d. for "Good" grade. Before sending off the cattle, the farmer had them valued by four farmers, and their

estimates of what the cattle would make in the local market were as follows :—

	Cwt. Live Weight	£	s.	d.
Black Steer	12½	33	15	0
Blue-Grey Steer	11	30	10	0
Black and White Steer	12	33	0	0
Red Steer	11¼	31	10	0
	46¾	128	15	0
Heifer No. 1	10	27	15	0
2	9	25	0	0
3	9	24	15	0
4	8¾	24	10	0
	36¾	102	0	0
TOTAL 8	83½	£230	15	0

One of the farmers estimated the dead weights at 104, 94, 102 and 90, making a total of 390 8-lb. stones, for the steers, and 84, 75¼, 73½, 73½, making a total of 306¼ 8-lb. stones, for the heifers—an aggregate of 696¼ 8-lb. stones dead weight for the eight beasts.

The cattle were railed to London on March 24, and, on slaughter, the carcasses were in each case graded "Select." The live and dead weights were as follows :—

	Live Weight 14-lb. Stone	Dead Weight 8-lb. Stone
Ox	97	102·6
Ox	84	88·5
Ox	94·7	100·5
Ox	89	95·7
	364·7	387·7
Heifer	79	86·3
Heifer	70	75·2
Heifer	71·7	76·2
Heifer	67·7	71·3
TOTAL	288·0	309·2

The total weight thus came out at 697 stone 1 lb. dead weight for the eight beasts, the local estimate of 696¼ stone proving to have been remarkably accurate. The actual gross return was £232 7s. 6d. less drover's charge from London station to abattoir, 7s. 2d., and carriage, £4 4s. 11d., the net return being £227 15s. 5d. The estimated gross return, as shown above, was £230 15s. 0d., from which auctioneer's charges, £2 10s. 0d., would have to be deducted, leaving a net return of £228 5s. 0d.

On this reckoning, the actual results came out very much the same. It so happened that there was some decline in price at the local auction on the day on which the cattle would have been sold, and in the opinion of the sender there was actually a gain, estimated by him at £10 on the transaction. Further, he had the advantage, before the cattle left the farm, of knowing, within a little, what they would fetch instead of having to take the risks of the auction.

Equally satisfactory results can be reported from the side of the meat trade. The cattle in question were of super-excellent quality. The London wholesaler has always difficulty in competing with local buyers for this class of cattle, since the local buyers have not to meet the heavy expenses which are necessarily involved in moving cattle to a distance and killing in an urban centre. It was, therefore, satisfactory to find that by this method of sale the wholesaler appeared to be able to pay as much as the local buyer would give for the best quality.

It is too early to say how far this method of sale is capable of expansion. If it is to be developed, some system of insuring cattle sent direct from farm to abattoir should be employed. When cattle are bought on the live-weight system in the auction mart the risk of condemnation for disease falls on the buyer, but under the dead-weight system it falls on the seller. It was pointed out in the Ministry's Report referred to that, in the latter event, wholesalers would also be exempt from most of the speculative risks of cattle buying, viz., the uncertainty as to killing-out percentage, shrinkage, presence of disease, etc., and would only pay for what they received. The producer should, therefore, receive some price compensation for accepting these risks. Moreover, cattle sent direct from farm to abattoir are subject to the minimum of travelling and may be expected to arrive in better condition than when they have passed through a market. The farmer would, of course, know before the animals left the farm what price he was going to receive, and would be able to compare the price quoted with the prices obtainable at the local auction.

Experience alone will show how far this method of selling can be carried, and what savings can, in practice, be effected by it. The way is, however, open for further experiments.

The Carton as a Package for Apples.*—The Wenatchee District Co-operative Association, Washington, have recently devised a new distribution system for apples sold under the *Jim Hill* brand name. These apples are now packed in small pasteboard boxes each containing 12 apples, all wrapped in tissue paper with the *Jim Hill* trade mark.

The new packaging plan makes use of a three-colour display carton for the "extra fancy" apples singled out for the new plan, states *Printer's Ink*. The bright red apple on the top cover of the carton is a "cut-out" and is made to be folded back in the window display of these apples.

Sizes packed in the new containers are those from 72's to 113's, which are best for eating fresh. Other sizes and grades are still packed in the usual boxes as heretofore, but the pick of the crop is carefully wrapped and given a double inspection, so that the apples which are sold in dozen lots will be as perfect as Nature can grow them, and have a "class appeal" to women in general.

The apples sold are grown by over 400 growers over an area of more than 7,500 acres in extent, and enjoy distribution into every State of the Union, and in many foreign countries.

* From the *Box Makers' Journal*, March, 1930.

The Effect of Grading on Canada's Food Products.—The following extracts are from a recent'y broadcast address in Canada by Dr. J. H. Grisdale, Deputy Minister of Agriculture for the Dominion. For many years, Canadian farmers were satisfied to go on producing as best they could, without any special concerted effort looking to the improvement of their products. Gradually, however, the Canadian farmer began to appreciate the fact that "hit or miss" methods and uncertainty in quality in his products were not likely to raise the price of his products, nor help him hold his old customers, let alone get new ones. He began to realize that something must be done, and the grading of our agricultural products began to be thought of. It was readily admitted by producer and consumer alike that, were all our products equal to the best of them, we might easily sell all we could produce, and do so at a considerably better price relatively than was at that time the case. To bring up the quality of goods produced by the careless farmer it seemed reasonable to suppose that the most effective and the most rational way was to pay for the article on the basis of its relative quality, the highest price for the best article, and not a flat price for any and every quality, as was very commonly done some years ago.

Who does not recall the days when the country storekeeper paid all farmers the same prices for their butter, though

some of it was very palatable and much more of it barely fit for axle grease? Which of us beyond childhood age does not remember when an egg was an egg when he bought it, whether it was laid yesterday or last June, and whether it was a real delicacy or a highly scented, disgusting mess when the shell was cracked. It seemed reasonable then to think that if the farmer who produced good butter was paid, say, 40 cents per pound and for a bad article was paid 20 cents per pound, then soon there would be something doing in the way of improvement in certain dairies. It seemed only right, too, that the person who put fresh new-laid eggs on the market should be better paid, much better paid, than he who saved his eggs in times of heavy production and put them on the market in time of scarcity, high-smelling or half-hatched as was often done.

It was felt, too, that this same principle should maintain right down the line.

It should be stated that this principle was really accepted or put into practice many years ago so far as wheat and grains were concerned, but it was not until comparatively recently that anyone seemed to think it might and should be applied to other products.

The first article other than cereals to receive serious attention was eggs. Action looking to the improvement of our eggs by this means dates back to about 1918. The struggle has been long, and the task difficult, but the results have justified the effort. Where, as already suggested, eggs were anything but a dependable article of diet 12 or 15 years ago, to-day, Canadian eggs of the higher grades are looked upon as quite safe to offer anyone for breakfast and need not be broken before coming on the table. The results of this improvement are astonishing. Canadian egg production has more than doubled in a little over a decade. Canadian eggs have made a name for themselves in quality, and consumption of eggs in Canada has increased enormously. Each person in Canada used to eat about 15 or 16 dozen eggs in the year; now, each person eats over 30 dozen in the same time.

Probably the next most striking example of what grading will do is what has happened to Canadian bacon. Some 30 years ago, some people in Canada decided that Canada's only chance of doing much to build up a good swine industry was to go in for production of Wiltshire bacon. For this article there was a good market in England, while for pork such as was then being produced in this country, the foreign and

even the domestic market was very uncertain. After a long struggle, a fairly high percentage of hogs suitable for conversion into this product began to come on the market. Quality was very uncertain, however, and prices even more unstable. Our reputation abroad may be best indicated by the statement that Canadian bacon was commonly quoted at from six to eight dollars a hundredweight less than the Danish article. After much effort and endless discussion, our present system of hog grading (approximately) was got under way. To-day Canadian bacon not infrequently commands as high a price as the Danish, and occasionally higher, while the spread is never more than a dollar or so per cwt. in favour of the Danish.

Another very striking example of what grading will do is seen in its effect on our common Canadian cheese. In the fall of 1922, when I happened to be in England, I could not help but be chagrined to note the poor reputation, shall I say, "enjoyed" by our Canadian cheese as against the New Zealand article. All of us interested in the dairy industry felt that something must be done. Something was done. A law was passed authorizing the grading of cheese and butter, and, after considerable discussion among the interests concerned, regulations were passed and the grading of cheese and butter for export went into effect in 1923. The effect has been quite all that was hoped for in improving the quality of our produce and in improving the reputation of our cheese, at least on the British market. So far as butter is concerned, it has not affected our foreign trade, for we sell but little abroad.

Our cheese in 1922, and for some time previously, had been selling from 1 to 2 cents per pound less than New Zealand. The situation changed almost immediately, and now Canadian cheese uniformly sells at a higher figure than the New Zealand. Here are the premiums year by year for the past five seasons. In 1925, 52 cents per lb., in 1926, 56 cents per lb., in 1927, 1·48 cents per lb., in 1928, 1·12 cents per lb., and in 1929, 2·01 cents per lb.

Grading did it. The makers did better because they knew their product was to be graded, and when they made a poor article every one concerned knew about it, and the maker got busy and did better. He had to, or lose his job.

Another article that has been graded for some time now is apples. Unfortunately for the producer, this article, while graded, is commercially inspected for trueness to grade only

in those provinces where the growers as a whole ask for it. This is the case in British Columbia, Ontario and Quebec. Nova Scotia, one of our principal apple producing provinces, has not yet asked to come under the commercial inspection scheme. Here, again, the effect of grading under inspection is establishing a reputation and the improvement of the quality of the output has been quite remarkable. Apples from British Columbia and Ontario now are commonly accepted on the British or American markets for what they purport to be, and are found to be such. The effects on prices are good. Apples from Nova Scotia, however, where grading under inspection is not in effect, are looked upon with suspicion and sell on sample or on local inspection very much to the disadvantage of the growers in that province. The inference seems obvious—get your apples inspected for trueness to grade.

Many other articles are graded, and results have been uniformly encouraging. Some of these are potatoes, turnips, wool, and poultry.

The product most recently to come in for attention is beef. Two grades have been established—"Choice" and "Good." A red stripe down the side of beef from hock to neck means "Choice," a blue line means "Good." We are hopeful that much good may result from the putting of this system into effect. Just what will happen, however, remains to be seen, since the policy is but just getting under way.

I think I have now said enough to indicate quite clearly and emphatically that grading is having a wonderful effect on the quality of our food products and is aiding materially in the marketing of them. What we want now is more of these products. We have quality: we need quantity, and we need continuity or regularity of output.

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THE FOOD AND FEEDING HABITS OF SOME CORVIDÆ

THE CARRION CROW, HOODED CROW, MAGPIE AND JAY

WALTER E. COLLINGE, D.Sc., F.L.S., M.B.O.U.,
Keeper of the Yorkshire Museum, York.

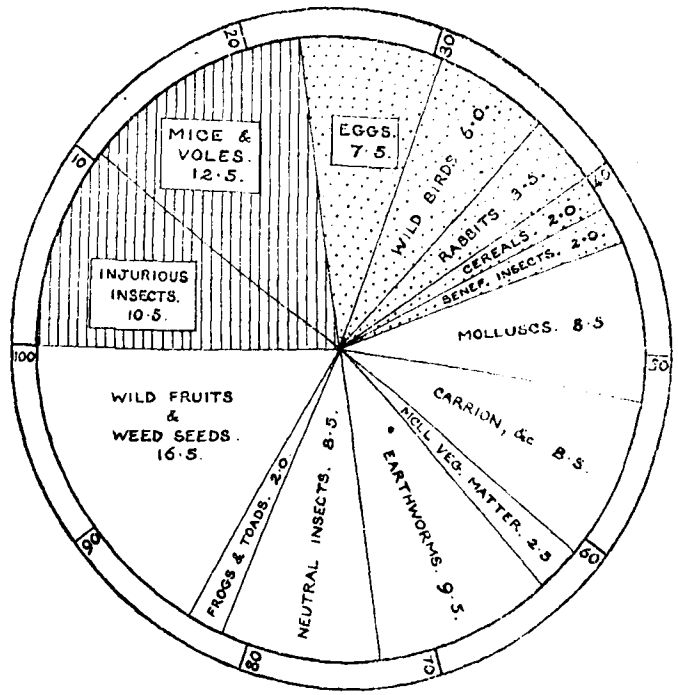
WE have previously set forth in detail the food and feeding habits of the Jackdaw* and the Rook†, and we now propose to treat of the economic status of four other members of the family of wild birds known as the *Corvidæ* or Crow family, viz., the Carrion Crow, the Hooded Crow, the Magpie and the Jay.

Among the whole of our British wild birds there are few families more difficult to deal with and to estimate the economic status of the different species than the Crow family, for their activities affect a wide series of interests, the least important of which—from an economic standpoint—is perhaps the noisiest and most persistent in their wholesale condemnation. It is therefore highly important that we draw no hasty conclusions, but endeavour to sift all the evidence and take a wide view of the sum total of their activities.

The persecution of the members of this family is due entirely to the fact that for a few weeks of the year they include among their food the eggs and young of game-birds; they have, moreover, also been known to take the eggs and young of poultry, and have been attacked for this reason. The amount of damage they thus entail has, in the writer's opinion, been exaggerated, and the benefits they confer have been almost ignored. If there were no preservation of game in this country we should hear fewer complaints against these birds; it is therefore essential that we should know, as precisely as possible, the actual damage they do, and carefully weigh against this the benefits they confer in the interests of agriculture.

The views held by some gamekeepers and others that any and everything that is prejudicial to the rearing of game-birds must be destroyed is just as illogical as the contention that anything that is prejudicial to the preservation of wild bird life must be abolished. A truer perspective of the actual conditions prevailing should tend to dispel many crude and incorrect opinions.

* This JOURNAL, 1919 (March), pp. 1445-1447.
† *Ibid.*, 1920 (December), pp. 868-875.



Food Analysis of the Carrion Crow.

The Carrion Crow.—This is a resident throughout Great Britain, and notwithstanding the numerous attempts to destroy it, it remains fairly common in wooded, estuarian and coastal districts. It is rare in the north of Scotland, and extremely so in Ireland.

Nest making commences about the middle of April. Tall trees or cliff ledges are the usual sites, but nests in low bushes and on the ground have been recorded. The nest consists of sticks and fine twigs lined with wool, hair, etc. Four to five bluish-green eggs, spotted and blotched with olive brown, are usual. The period of incubation is 18 to 19 days, and there is a single brood only. Between September and November many birds from central Europe arrive on our east coast. Inquiries made as to an increase or decrease in recent years point to the fact that they are not so plentiful as in the past.

Food Habits.—Of the total food consumed in a year the percentages are as follows:—Animal food 79·0 per cent., of which 10·5 per cent. consists of injurious insects and their larvæ, 8·5 per cent. of neutral insects, and 2 per cent. of beneficial species, 12·5 per cent. of mice and voles, 8·5 per cent. of carrion and shore refuse, 8·5 per cent. of molluscs, 9·5 per cent.

of earthworms, 7·5 per cent. eggs of wild birds, 6 per cent. remains of birds, 3·5 per cent. remains of young rabbits, and 2 per cent. of frogs and toads. Vegetable matter is represented by 2 per cent. of cereals, 16·5 per cent. of wild fruits and weed seeds, and 2·5 per cent. of unidentifiable vegetable matter. The items eggs of wild birds and remains of birds includes blackbirds and wood pigeons, but we have included both items amongst the injuries.

Summarizing the above percentages we find that, of the total food consumed in a year, 23 per cent. constitutes a benefit to the farmer and fruit grower, 56 per cent. is of a neutral nature, and 21 per cent. can be regarded as injurious.

These injuries consist of the destruction of young rabbits (not a very serious loss), young birds, including game-birds, poultry, wood-pigeons, blackbirds, etc., the eggs of various wild birds and game-birds, and a very small amount of grain.

Apart from the destruction of game-birds, poultry and their eggs, the injuries that this species inflicts are very small, over half of their food being of a neutral nature. The farmer and fruit-grower are benefited by the 10·5 per cent. of injurious insects and the 12·5 per cent. of mice and voles destroyed, though the farmer suffers a loss of 2 per cent. of cereals.

Much as we sympathize with the game preserver and poultry keeper over the young birds and their eggs which are destroyed, the claims of the farmer and fruit-grower outweigh them, and we are forced to the conclusion that in spite of all that can be said against this bird it is much more beneficial than injurious.

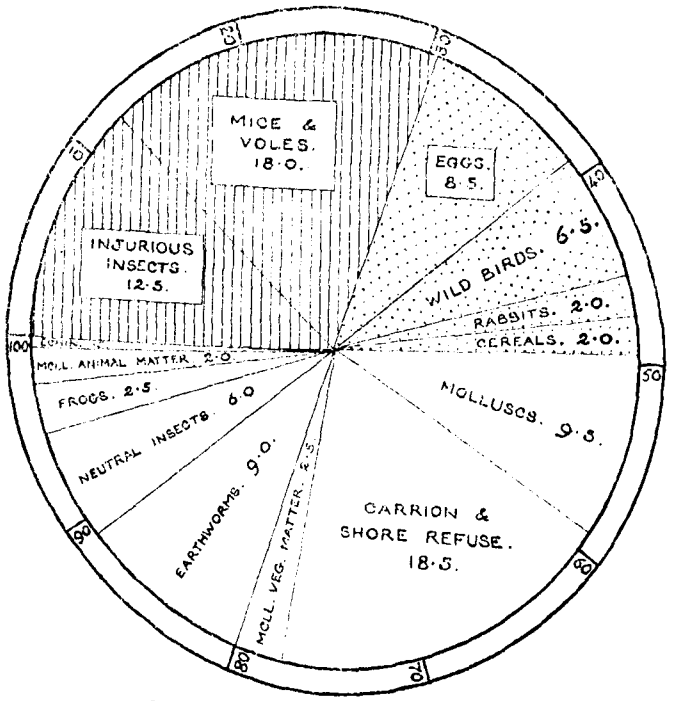
The Hooded Crow.—The Hooded or Grey Crow is resident in northern Scotland, the Isle of Man and Ireland, and numbers of the birds visit England and Wales from October to April.

In Ireland, the eggs have been recorded as early as the middle of March, in Scotland later. The nest and eggs are similar to those of the Carrion Crow.

From the beginning of October to the early part of November, large numbers of migrants arrive on the east coast of Great Britain from Scandinavia and central Europe.

This species is said to interbreed with the Carrion Crow. It is a much bolder bird than the Carrion Crow and more gregarious. It has been known to attack weakly lambs and to boldly raid poultry, and yet in spite of these delinquencies it accomplishes a large amount of good.

Food Habits.—Animal food constitutes 95·5 per cent. of the total food consumed, of which 12·5 per cent. consists of injurious



Food Analysis of the Hooded Crow.

insects and their larvæ, 6 per cent. of neutral insects, 18 per cent. of mice and voles, 2 per cent. of young rabbits, 6·5 per cent. of remains of birds, 8·5 per cent. eggs of wild birds, 2·5 per cent. of frogs, 9·5 per cent. of molluscs, 9 per cent. of earthworms, 0·5 per cent. of echinoderms, 18·5 per cent. of carrion and shore refuse, and 2 per cent. of unidentified animal matter. The vegetable food consists of 2 per cent. of cereals and 2·5 per cent. of miscellaneous vegetable matter.

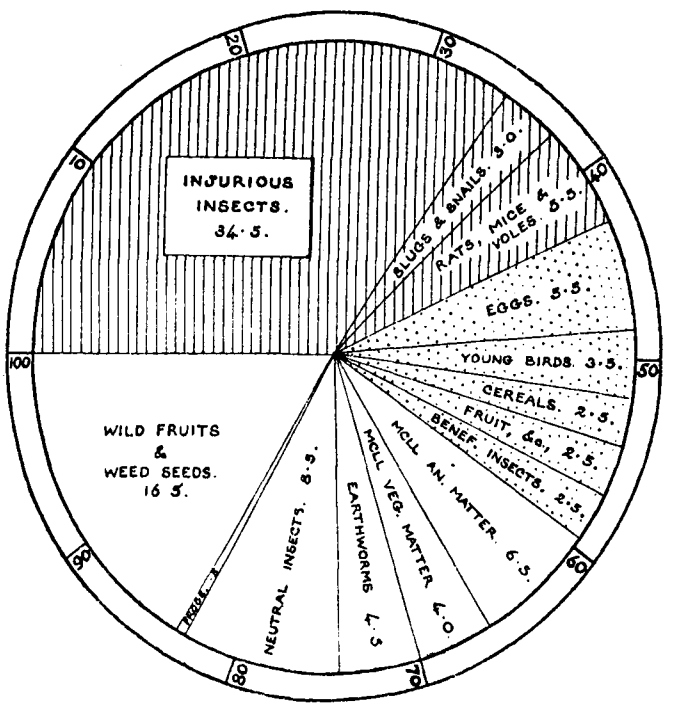
Summarizing the above percentages of the total animal consumption of food we find that 30·5 per cent. constitutes a benefit to the farmer and fruit-grower, 50·5 per cent. is of a neutral nature, and only 19 per cent. injurious.

Among the remains of birds were wood-pigeons, blackbirds and gulls, and, amongst the eggs, those of gulls and ducks predominated. The injuries therefore consist of the destruction of a few young rabbits, game-birds and the eggs of the latter, and 2 per cent. of cereals. Against this we have to consider the 12·5 per cent. of injurious insects and their larvæ, and 18 per cent. of mice and voles destroyed. Here again we are compelled to give the verdict in favour of the Hooded Crow, provided, of course, that its numbers are not permitted to increase unduly.

The Magpie.—The Magpie is a widely distributed resident throughout Great Britain. Nest building commences at the end of March or early in April. The large domed nest is constructed of sticks held together by a foundation of clay, and lined with fine roots and dry grass. The number of eggs varies from five to eight, the ground colour is usually a blue-green with closely set spots and specks of brown and grey. Incubation lasts 17 or 18 days, and the fledging period about 28 days. There is a single brood only.

Food Habits.—Animal food constitutes 74·5 per cent. of the total food consumed, of which 34·5 per cent. consists of injurious insects, 2·5 per cent. of beneficial insects 8·5 per cent. of neutral insects, 3 per cent. of slugs and snails, 5·5 per cent. of rats, mice and voles, 3·5 per cent. of young birds, 5·5 per cent. of eggs of wild birds, 0·5 per cent. of frogs, 4·5 per cent. of earthworms, and 6·5 per cent. of miscellaneous animal matter. The vegetable food consists of 2·5 per cent. of cereals, 2·5 per cent. of fruit, peas and potatoes, 16·5 per cent. of wild fruits and weed seeds, and 4 per cent. of miscellaneous vegetable matter.

Summarizing the above figures, we find that 43 per cent. of the food constitutes a benefit to the farmer and fruit-grower,



Food Analysis of the Magpie.

40·5 per cent. is of a neutral nature and only 16·5 per cent. injurious.

The large percentage of injurious insects destroyed by the magpie at once giv s it a place amongst birds which are beneficial to agriculture, and, inveterate thief as it is, the harm it does is more than counterbalanced by the benefits it confers.

The Jay.—This handsome bird is a resident in Great Britain. It is fairly common in most parts of England, rarer in Scotland and confined to the south-eastern parts of Ireland.

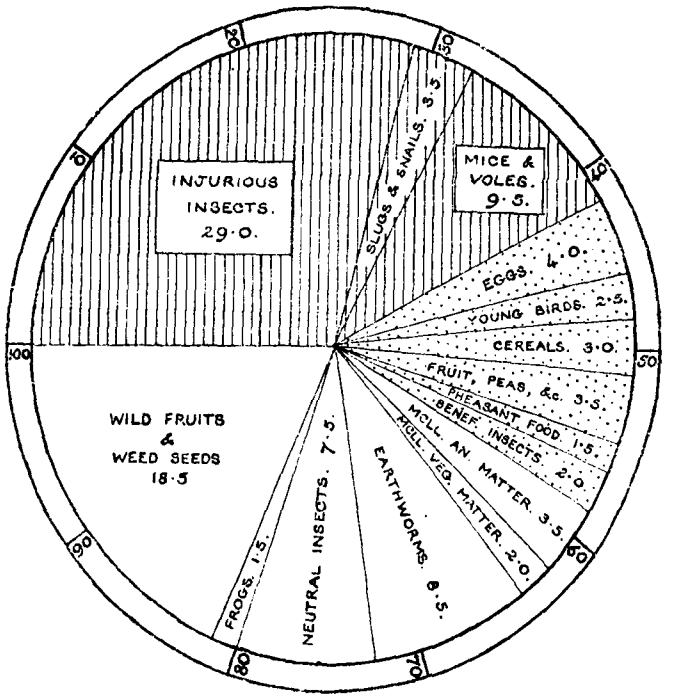
Nest building commences early in April. The nest is a cup-shaped structure of sticks and twigs, lined with mud, fine roots and grass. It is usually built in trees or tall thick bushes. The eggs are five or six in number, of a dusky green colour, thickly spotted with light olive brown, and with black hair-like lines. The period of incubation is about 16 days. There is but one brood. During the autumn large flocks from the Continent visit our east coasts. During recent years in many districts the Jay has become rarer.

Food Habits.—Of the total food consumed in a year 71·5 per cent. is animal food and 28·5 per cent. vegetable food. Of the former 29 per cent. consists of injurious insects, 2 per cent. beneficial insects, and 7·5 per cent. neutral insects; 3·5 per cent. of slugs and snails, 9·5 per cent. of mice and voles, 1·5 per cent. of frogs, 4 per cent. of eggs of wild birds, 2·5 per cent. of young birds, 8·5 per cent. of earthworms, and 3·5 per cent. of miscellaneous animal matter. The vegetable content consists of 18·5 per cent. of wild fruits and weed seeds, 3·5 per cent. of cultivated fruits, peas, etc., 3 per cent. of cereals, 1·5 per cent. of pheasant food, and 2 per cent. of miscellaneous vegetable food.

Summarized, the above record shows that 42 per cent. of the food is beneficial, 41·5 per cent. neutral and 16·5 per cent. injurious.

Nearly one-half of the animal food of the Jay, or 29 per cent., consists of injurious insects and their larvæ. Chief amongst these are the larvæ and adults of the Cockchafer, numerous species of weevils, the caterpillars of the Winter Moth (*Cheimatobia brumata* Linn.), the Turnip Dart-Moth (*Agrotis segetum* Schiff.), the Heart and Dart Moth (*A. exclamationis* Linn.) and many other species.

The Jay undoubtedly destroys the eggs of game-birds, though personally we have never met with any remains;



Food Analysis of the Jay.

on the other hand, fragments of the egg-shells of the Wood-Pigeon and Blackbird constitute the bulk of such food. Amongst the remains of young birds only those of the wood-pigeon and blackbird have been found.

Hitherto we have regarded the Jay as an almost neutral factor, believing, from numerical counts of the food items, that any injuries were fully compensated for by the destruction of injurious insects and their larvæ, slugs and snails and mice. Volumetric analyses of the stomach contents, however, show this bird to be a much more valuable economic factor than we had hitherto supposed. It must be borne in mind that eggs and young game-birds are only available for a very short period, as are cultivated fruits, and that for the greater part of the year the Jay is feeding upon insects, slugs and snails, mice and voles, frogs, earthworms and wild fruits and weed seeds.

Summary.—Having now obtained definite data with reference to the food of the four species of wild birds here treated of, we can endeavour to summarize their activities. The average amount of injurious insects they destroy is 21·6 per

cent., of mice and voles 11·4 per cent. and about 3 per cent. of slugs and snails. In other words, 36 per cent. of their food is of direct benefit to the farmer and fruit-grower, whilst injuries to the extent of about 18 per cent. are recorded, fully half of which consist in the destruction of the eggs and young of the wood-pigeon, blackbird, gulls and ducks.

From the standpoint of the farmer, these birds are a valuable asset, and any attempt at complete destruction of them at present is prejudicial to his interests.

So far as game preservation is concerned, the injuries are not excessive; indeed, as already indicated, we believe they have been over-estimated. In this investigation on this point we have not relied solely upon stomach contents, but have relied to a large extent upon the field observations of farmers, gamekeepers and other correspondents.

TABLE SHOWING THE PERCENTAGES AND AVERAGES OF BENEFICIAL, INJURIOUS AND NEUTRAL FOOD CONSUMED BY SIX SPECIES OF CORVIDÆ.

Species	*Benefits*	*Injuries*	*Neutral*
(1) Carrion Crow	23·0	21·0	56·0
(2) Hooded Crow	30·5	19·0	50·5
(3) Jackdaw	48·5	23·0	28·5
(4) Rook	28·5	52·0	19·5
(5) Magpie	43·0	16·5	40·5
(6) Jay	42·0	16·5	41·5
Total	215·5	148·0	236·5
Averages ..	35·9	24·7	39·4

In conclusion there are two very important points in connexion with the economic status of the members of the family *Corvidæ* which we should like to emphasize. First, so long as these birds are not too numerous we believe that the benefits they confer far outweigh any injuries they inflict, but if, as in the case of the Rook, they rise above the "high-water mark of abundance," the injuries are greater than the benefits. Secondly, the persecution of the four species here treated of is, in the writer's opinion, largely, if not entirely, due to misunderstanding. By countenancing such destruction the agriculturist is robbing himself of a valuable economic factor, since the four species are all distinctly beneficial to agriculture.

POTATO LEAF-ROLL

Development of Secondary Symptoms in the Year of Infection*

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WHEN well-grown potato plants first become infected with Leaf-Roll in the field they either do not show any symptoms or show only a rolling and coloration of the upper leaflets, these being regarded as "primary" symptoms. In either case the progeny, when planted in the following season, develop the full or secondary characters of Leaf-Roll about one month after appearing above ground. On the other hand, it has been shown by Murphy[2] that secondary symptoms develop in plants which become infected during sprouting, whilst several workers have noticed that, under some conditions, primary symptoms may pass into the secondary form in the same plant. No details have been recorded as to the stage of growth of plants showing this transition from primary to secondary symptoms, yet this is a matter of considerable practical importance both to the ordinary grower and to the seed producer. It is of importance to the former, because infection during the current season (*i.e.* "primary" infection) produces no appreciable reduction in yield, whereas plants showing secondary Leaf-Roll suffer severely both in the number and—in many varieties—in the size of tubers in the crop. The seed producer is affected, since it is at present assumed that the amount of secondary Leaf-Roll present in a crop is an index to its prevalence in the seed stock from which that crop was grown.

It seemed to the writers that the only way to clear up this point was to determine whether a stage exists in the growth of a potato plant prior to which infection might give rise to secondary symptoms, evident during the year of infection, but beyond which, in order to demonstrate that infection had occurred, it would be necessary to grow the progeny in the following season. To test this possibility, plants of two varieties and in varying stages of growth have been exposed to infection for the same lengths of time by the same number of aphides carrying the Leaf-Roll virus. The details are as follow:—Cores with eyes were taken from three healthy tubers each of Kerr's Pink and Arran Comrade, and were potted up in an

* A brief preliminary note under this title appeared in the *Scottish Journal of Agriculture*, Vol. xii, No. 2, April, 1929, p. 214.

aphis-free glasshouse on November 19, 1928; thereafter, a similar number were potted at weekly intervals, until by February 9, 1929, 60 plants were assembled in 10 distinct stages of growth—the three oldest plants of each variety being about 3 ft. in height and the youngest just unfolding their first leaves. In the meantime, aphides, originating from Soya beans, were fed on plants affected with Leaf-Roll in an aphis-proof glasshouse from November 7, 1928, until February 9, 1929, by which time several generations had appeared, and the aphides could reasonably be relied upon to carry the virus. On this latter date, 10 aphides, collected from several plants affected with Leaf-Roll, were placed on the upper leaves of each of the 60 experimental plants; on February 20, two more aphides were placed on each plant, and a further two on February 27. On the evening of March 7, the glasshouse containing the aphis-infested plants was thoroughly fumigated with hydrocyanic gas evolved from calcium cyanide, and again on the following evening to ensure a complete "kill" of the insects. Careful examination of each plant during the remaining period of the experiment proved that no aphides had survived the fumigation and none had subsequently gained entrance to the glasshouse.

Results.—(1) *Rolling of Leaves already expanded.*—Some rolling of the leaves was apparent on March 7, when the house was fumigated, and within the next day or two the appearance shown in Fig. 1 (Arran Comrade) and Fig. 2 (Kerr's Pink) was reached. Typical secondary symptoms of Leaf-Roll had developed on all the Arran Comrade plants which had been planted eight weeks (or less) before the date of aphis infestation. Those planted nine, ten and eleven weeks before infestation showed rolling only in the uppermost leaves, *i.e.*, "primary" symptoms, whilst the oldest series at first appeared normal, but later also developed primary symptoms. In the variety Kerr's Pink, the reaction was less marked, secondary symptoms developing only in those planted up to five weeks before infestation, *i.e.*, in the three youngest series. At the outset there were no symptoms on the plants in the older series, but by March 25, rolling of the upper leaves could be seen in the six-weeks-old series, and ultimately all the plants followed suit. Each variety could then be divided into a set showing typical secondary symptoms, and one with definite "primary" characters; gradually, however, the older leaves of the primarily rolled plants rolled successively from the top to the base of the plants. This is illustrated in Figs. 5 and 6,

Fig. 6.

Fig. 5.

Fig. 4.

Fig. 3.

FIGS. 3 and 4.—Plants taken from each series ("Kerr's Pink" and "Arran Comrade") one month later than as shown in Figs. 1 and 2. Views show the small amount of new growth in length after the original leaves rolled. The new leaves in Fig. 3 are still normal, but in Fig. 4 some slight rolling of the new leaves has begun.

FIG. 5.—An "Arran Comrade" plant (15 weeks old: cf. Fig. 1) taken four weeks after the infected aphides were placed on it, and now showing rolling only in the upper leaves.

FIG. 6.—Same plant as Fig. 5, photographed one month later, and showing all original leaves rolled: rosette axillary shoots still normal.

which show the same plant (*a*) when the top leaves only were rolled, and (b) after the rolling had spread to all leaves.

(2) *Rolling of Leaves developed after Aphis Infestation.*—A comparison of the plants shown in Figs. 3 (Kerr's Pink) and 4 (Arran Comrade) with the same plants in Figs. 1 and 2 clearly indicates the small amount of new growth produced in the interval between the dates on which the photographs were taken (*i.e.* four weeks), the retardation of growth giving more or less of a "rosette" appearance to the plants. The new leaves were at first normal, but, after the lapse of about one month, they gradually rolled like the original leaves, and no further growth occurred. In the older, "primarily" infected plants, the effect of the disease was even more marked, for no growth in length occurred after the upper leaves had once become rolled—as can be seen by comparing Figs. 5 and 6. There was, however, a pronounced activity of the axillary buds, and these developed rosettes of foliage in the axils of most of the rolled leaves. The young axillary leaves, also, were normal during the first month of their growth, but thereafter most of them rolled like the leaves subtending them. The writers are of the opinion that the regularity of the occurrence of a month between infection and the appearance of symptoms suggests that this is a necessary "incubation period" for the virus in the leaf.

Discussion of Results.—Proof that the rolling of the leaves was due to infesting the plants with aphides from Leaf-Roll plants was afforded by planting the original tubers from which the cores had been taken. All these tubers produced plants free from Leaf-Roll. That the rolling was true Leaf-Roll and not due to glasshouse conditions of growth was proved by the use of Sachs' Iodine Test and by growing on the progeny in the field in the following season; all, with the exception of one tuber, developing pronounced symptoms of secondary Leaf-Roll. The difference in the reaction of the two varieties to infection is worth noting, although we are quite ignorant as to its cause. The difference in the reaction of the young and old plants of both varieties was clearly not due to any appreciable difference in the amount of virus transferred by the aphides, since the same number fed for the same period on all plants. We must conclude, therefore, that the difference in symptoms was entirely due to the difference in age of the plants when infected. From this it follows that secondary symptoms may be expected to develop in plants that are infested with aphides before a

certain stage of growth is reached. The maximum size of plant which will develop secondary symptoms in the year of infection varies, as this work shows, with the variety; but it is evident that the date of aphis infestation in a crop must be known before assuming that the presence of Leaf-Roll affords a reliable index to the health of the original seed-stock.

It might be argued that the practical effects of the facts reported upon in this paper are almost nil, since aphis infestation does not usually begin until the plants are well past the critical stage of growth. In reality there is an almost complete absence of reliable information as to the distribution in time and space of the insect carriers of Leaf-Roll; and until such information is to hand for the whole country it is impossible to assess the bearing of these new facts on the prevalence of the disease in potato crops. It may prove to be significant that Leaf-Roll is apparently much more common in potato crops in England than it is in Scotland.[1] A detailed survey of the occurrence of insect carriers of Leaf-Roll and other virus diseases would be of great service in the attempt to raise the standard of potato crops in this country. At Bangor, for instance, the number of possible insect carriers of Leaf-Roll has increased from none in 1921 to a relatively high number in 1929, and Walton[4] found that an increase in aphides at Bangor in 1924 was not accompanied by a general increase along the Caernarvonshire coast, but rather the reverse. He concludes that shelter plays a very important part in aphis infestation of potatoes, and records, under such conditions, the occurrence of aphides as early as March 7 on "volunteer" potatoes near Bangor. The writers are inclined to attribute the absence of aphides at Bangor in 1921 to the exceptionally wet summer of the preceding year. The abnormally high rainfall of 1920 was experienced in certain areas only, and it would be interesting to know whether in other parts of the country (*e.g.* Fife) where the rainfall was subnormal in that year there was a different effect on the aphis population.

It might also be supposed that since leaf rolling normally takes a month to develop after the first appearance of the plant above ground, any potato insects present would be unable to transmit the disease to a variety such as Kerr's Pink, which had, apparently, passed the critical stage within five weeks after planting (*i.e.*, after three weeks above ground under glasshouse conditions). The supposition, however, is incorrect, since insects can pick up the virus from infected plants before any symptoms develop. In an experiment,

carried out by the writers, young aphides were transferred from plants affected with Leaf-Roll, before any symptoms appeared, to eight healthy Arran Comrade plants about 3 ft. in height, on which they remained for 18 days before fumigation. All the plants became infected, first showing "primary" symptoms, which gradually spread down the plants until all leaves were severely rolled. Indeed, Murphy has shown that transmission can occur from the sprouts of infected tubers, although, in this case, aphides picked up the disease with uncertainty and very irregularly.[3]

The writers wish to acknowledge the help given by the laboratory assistant, Mr. G. L. Turner, and the care he exercised in growing the plants for this experiment.

Summary.—Evidence is submitted to prove that, under glasshouse conditions, secondary symptoms of Leaf-Roll may develop in the year of infection.

Secondary symptoms, in these experiments, developed in all plants of the variety Arran Comrade that were intentionally infected eight weeks (or less) after planting; and in the variety Kerr's Pink up to five weeks after planting.

Older plants in both varieties showed rolling first in their upper leaves, followed by rolling of each older leaf in succession until all had developed pronounced symptoms.

Infection was marked by an almost complete cessation of growth in length; axillary buds produced rosettes of leaves, which, after the lapse of about one month, also rolled. This is adduced as evidence that one month is the minimum period of "incubation" of the virus before external symptoms can appear.

It is suggested that the presence of secondarily infected plants in a crop will afford a reliable index of the degree of infection of the seed-stock only if it is known that the plants had passed a certain critical stage in growth (varying with the variety) before aphis infestation occurred.

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THE CONTROL OF THE APPLE BLOSSOM WEEVIL

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Corrugated Cardboard Bands and Felt Bands for Control of the Weevil.—It has been established for some years now that the Apple Blossom Weevil (*Anthonomus pomorum* (L.) Curt.) can be largely controlled by the simple process of trapping the weevils in sack bands, which are placed around the tree trunks. This method, which has been fully described elsewhere,* is briefly as follows. Discarded bags or sacking are cut into long strips about 6 in. wide. Each strip is cut so that its length will be at least twice the circumference of the tree, in order that the band may be of double thickness when placed round the trunk. These sack bands are placed around the tree trunks during the latter part of May and in June. One tie in the centre is sufficient to secure the band. The weevils crawl into the bands to hibernate and remain there until the following spring. The bands are left unattended on the trees until November or December, when they are removed and the weevils in them destroyed.

On large fruit farms, where thousands of trees have to be banded, it is sometimes difficult to obtain sufficient old sacking material for the purpose, and the time occupied in cutting the sacking into strips is considerable. In addition, it is not an easy matter to gauge the approximate length of each strip for individual trees, unless the sacking is prepared on the spot, and in practice on a large scale this is not to be recommended.

For these reasons, an experiment was undertaken in the summer of 1929 to determine whether it were possible to use strips of old carpet felt, and rolls of corrugated cardboard covered on one surface by grease-proof paper, for trapping the weevils, instead of the ordinary sack bands frequently recommended for this purpose.

The trial was carried out in an established plantation, consisting of standard Lord Derby trees, situated on a farm near East Malling. These trees are particularly suitable for the

* The Control of the Apple Blossom Weevil. A. M. Massee, *East Malling Res. Sta. Ann. Report*, 1924.

experiment, since a large proportion of the blossoms have been destroyed by the Apple Blossom Weevil for several years in succession.

Three types of bands were used in the test: (1) Carpet felt ¼ in. thick, cut into strips about 6 in. wide, of single thickness only; (2) Strips of corrugated cardboard 4½ in. wide, covered on the smooth surface by grease-proof paper of single thickness only; and (3) Ordinary sacking material, in strips 4½ in. wide, the length of the sacking being twice the circumference of the stem of the tree, to make a double thickness when in position.

The corrugated cardboard and carpet felt bands were used at single thickness only in every case.

All the bands were put on the trees on July 16 and 17, about one month later than the recognized date for placing the bands in position on the trees. The bands were not examined or touched until the date of their removal.

The bands were removed on November 24, and the weevils hibernating in them were sorted out and counted. These weevil counts were carried out in the laboratory and in a private residence at East Malling. On account of the large number of weevils in many of the bands, the counts occupied a considerable time, and the actual examination of the bands was not completed until December 14. Nevertheless, the time occupied in counting and sorting out the weevils from the bands is not considered to have affected the results obtained, since, once the bands were removed from the trees, they were placed in sacks and kept under large bell jars, which prevented the weevils from escaping.

The following table shows the number of weevils caught in each type of band :—

TABLE I.—COMPARISON OF NUMBER OF WEEVILS CAUGHT IN SACKING, FELT AND CORRUGATED CARDBOARD BANDS

Type of Band	*Number of Bands*	*Total Weevils*	*Average per Band*
Sack band ..	48	1,948	40
Carpet felt ..	21	4,338	206
Corrugated Cardboard ..	37	14,448	390

The table shows that the number of weevils caught in the corrugated cardboard bands amounted to 14,448, while only 1,948 weevils were found in the sack bands, despite the fact that 11 more sack bands were examined. The total number of weevils found in the carpet felt bands totalled 4,338, which is also a considerable increase compared with those found in the sack bands. The total caught per band was

greatly in favour of the corrugated cardboard, followed by carpet felt, with sacking far behind.

The weevils seem to prefer the corrugated cardboard bands to the sack bands for two reasons: (1) they are able to crawl in between the various layers of cardboard, which part on becoming wet after a rainy period and afford them an excellent place to shelter in; and (2) the inside layers of the cardboard bands do not appear to become sodden after continued rainy weather. This is due to the protection afforded by the grease-proof paper. On the other hand, the sack bands become saturated after heavy rains, and remain in that condition for several days. This may deter the weevils to some extent from going into the bands.

The fact that large numbers of weevils can be caught in the corrugated cardboard bands should render the weevil problem a very simple one for fruit growers, since it ought to be quite a simple business to take a roll of corrugated cardboard into the orchard, cut off strips the required length, and place the bands around the trees without previous preparation.

This type of trap has been recommended for the dual purpose of trapping the Apple Blossom Weevil and catching the Winter Moth. The one band, however, is not to be recommended for the two purposes. The bands must be removed during December, or in January at the latest, to destroy the weevils, whereas if the bands had been greased to catch the female Winter Moths as well, they would have to remain on the trees until the end of February, and by this time most of the weevils would have departed.

The total cost of corrugated cardboard bands as compared with sack bands works out as under, the estimate in each case being based on 200 bands, each band being 18 in. long:—

Corrugated Cardboard Bands.—Cost of bands and labour entailed in putting bands on the trees works out at about 10s.

Sack bands.—Cost of new material, labour required for cutting the sacking up into strips and placing the bands round the trees is, approximately, 20s.

Thus, where new sacking has to be bought, the cost is double that of the corrugated cardboard bands. When old sacking is available on the farm, however, the price works out about the same as that reckoned for the corrugated cardboard bands.

Although the carpet felt band attracts the weevil to a very considerable extent, it is doubtful whether this type of band will be used on a large scale on account of the high cost of

the material, and the difficulty of obtaining sufficient of it for banding large areas.

The result of the above trial is considered to be very encouraging, and it is proposed to repeat the experiment again next summer.

A New Method of Destroying Weevils Trapped in the "Sack Bands."—Although it has been shown that the corrugated cardboard bands are more efficient than sack bands, growers will doubtless continue to use sacking, especially on farms where old sacking is available for this purpose, and some method of killing the weevils in the sack bands is, therefore, desirable.

As soon as the "sack band" traps are removed from the apple trees in November or December it is imperative to treat the bands in some way, to ensure that all the weevils hibernating in them are killed, before they are able to escape.

In the past, various methods have been employed for destroying the weevils in the bands, the simplest measure being to burn the sacking as soon as possible after removal from the trees. While burning proves efficient on a small scale, it cannot be considered practicable on large farms where economy in sacking might be necessary, especially where it is proposed to band again the following season. The practice of submerging the sacking in a tub of water to which a film of paraffin is added, to prevent the weevils from escaping, has not proved a success, since it has been found that many of the weevils escape unharmed. Another plan commonly used by growers is to dip the bands in boiling water, and this has also proved to be efficient on a small scale; but the difficulty of keeping a large quantity of water at a sufficiently high temperature to destroy the weevils makes this method unsuitable in many cases.

It occurred to one of the writers, in the spring of 1929, that it might be possible to destroy the weevils in the bands without removing them from the trees. If this were possible, it seems reasonable to suggest that those hibernating on the tree trunks, immediately beneath the bands, would also be destroyed by the same treatment; in all the old methods suggested for control, all these weevils escaped unharmed.

With this point in mind, an experiment was carried out, in the autumn of 1929, to determine the effect of spraying the bands on the trees with a tar-distillate winter wash.

Some half-standard Lord Derby trees, growing on a farm near East Malling, proved quite suitable for the purpose.

The trees had been banded earlier in the year by the owner, and a subsequent examination of some of these bands, at the end of September, showed that weevils were present in sufficient numbers to make the experiment worth while.

Two rows, each consisting of 44 trees, were selected. The bands of alternate trees of each row were sprayed with a proprietary brand of tar-distillate. Thus the bands of 22 trees of each row received the winter wash. The tar-distillate was used at a strength of 10 per cent., and was applied on October 4. The wash was applied by means of a knapsack sprayer, and although the pressure was poor, it was found possible to wet each band thoroughly. It was put on at the rate of 2½ gal. of diluted wash to every 18 bands.

The weather conditions at the time of spraying were ideal, and the wash dried very readily on the bands. The bands were examined to determine the fate of the weevils on October 23 and 24, and on November 2 and 5 respectively, each examination being conducted in the field.

The method of examining the bands was as follows:—A large white sheet was spread immediately beneath the tree to be examined. The band was then carefully removed from the trunk and placed on the sheet. Next, before the band was examined, the weevils left on the trunk, immediately beneath the band, were collected in a glass-topped specimen tin. The weevils from the band and any that had fallen on the sheet were then collected and placed in a similar tin. The weevils from all the bands, sprayed and unsprayed, were collected in the same manner.

In the first row all the weevils were collected in four specimen tins—two for the sprayed bands (one for those on the band itself, and the other for those on the trunk) and, similarly, two for the unsprayed bands. In the second row the weevils from band and trunk were collected separately from individual trees. Therefore, in this row, two tins were required *per tree*.

When all the weevils had been collected in the manner described above, they were taken to the laboratory for the final examination. In this final count, the weevils were separated in three groups, namely, dead, paralyzed and alive.

Fortunately, a majority of the living weevils began to walk about after being in the warm laboratory for some few hours, enabling this group to be picked out with ease.

It was found more difficult to distinguish between the paralyzed weevils and those killed by the spray. However,

a means of separating these two groups was finally discovered. Each weevil was picked up in turn by its snout by means of a small pair of forceps, and it was noticed that if there were any sign of life in the insect it would wriggle furiously in an effort to escape. Weevils which did not move after this treatment invariably proved to be dead.

The paralyzed weevils were set aside for observation to determine whether they would recover or die. Ten days later, all these were found to be dead. The fact that some of the weevils were found to be paralyzed but not dead one month after spraying can be explained. It was found that weevils sprayed with a tar-distillate wash (10 per cent.) were not always killed instantaneously, but sometimes lived a month or six weeks after treatment, most of them dying within that time.

Table II makes a comparison between the weevils of treated and unsprayed bands of Row 1.

TABLE II.—COMPARISON BETWEEN SPRAYED AND UNSPRAYED BANDS; SHOWING NUMBER OF WEEVILS FOUND HIBERNATING IN THE BANDS, AND ON THE TRUNKS IMMEDIATELY BENEATH THEM

Treatment	*Dead*	*Paralyzed*	*Alive*
Sprayed bands	870	76	41
Sprayed trunks (under band)	203	36	31
Totals	1,073	112	72
Unsprayed bands	27	Nil	1,268
Unsprayed trunks (under band)	20	Nil	755
Totals	47	—	2,023

The table shows that a majority of the weevils in the treated bands and on the trunks were either killed or paralyzed by the spray. In fact, only 6 per cent. of the weevils collected from these treated bands and trees proved to be alive.

On the other hand, a very high percentage of the weevils collected from the untreated bands and trunks were found to be alive. Only 47 were found dead and none paralyzed. Nearly twice the number of weevils were obtained from the untreated bands as compared with the sprayed bands. This point will be referred to and explained later.

It will be noted also that a good proportion of the weevils were found hibernating on the trunks immediately beneath the bands, and not on the "sack bands" themselves.

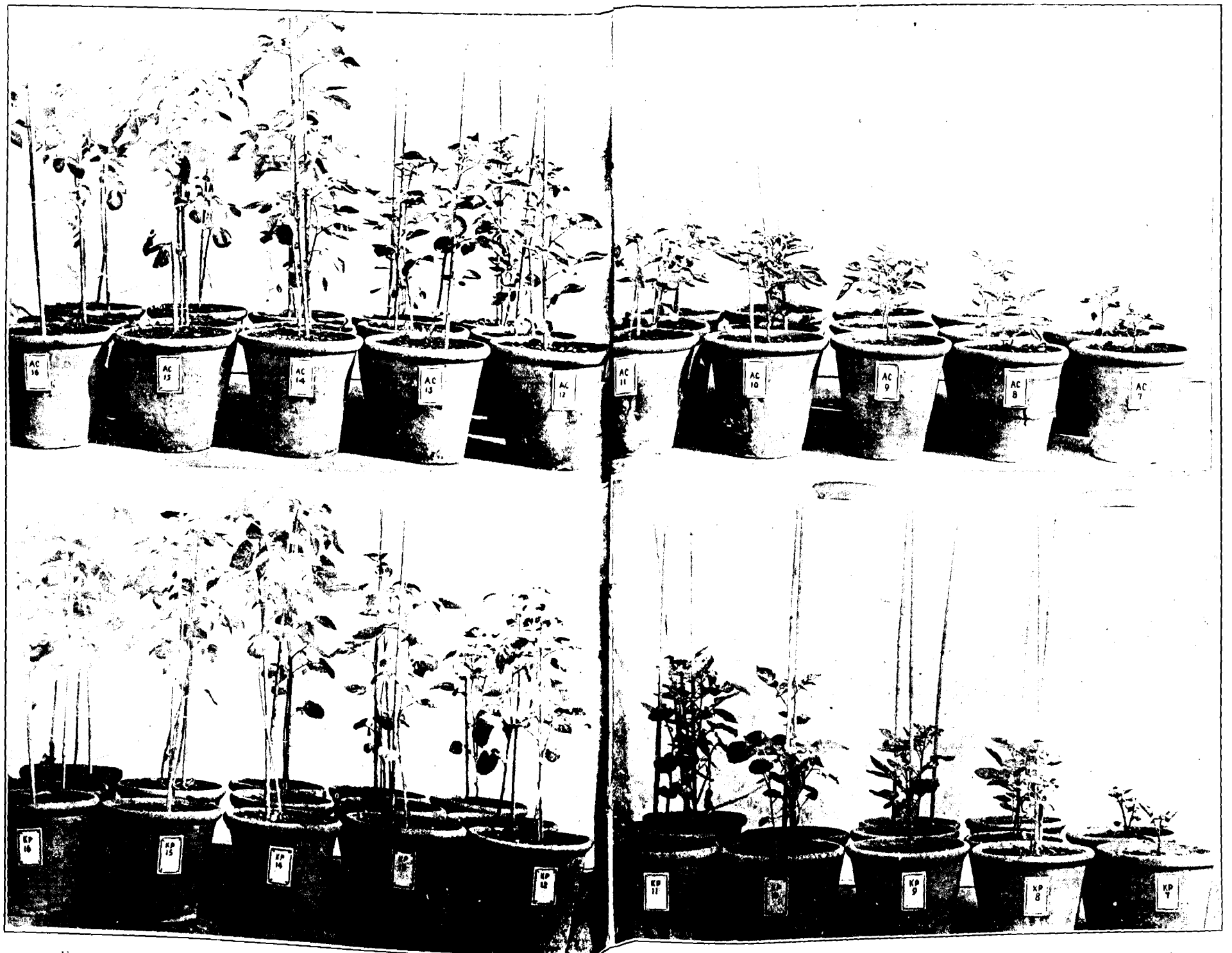

FIG. 1. *Top Row (right to left).* Variety "Arran Commade," showing secondary Leaf-Roll in the six youngest of the series (*i.e.*, plants from 7 to 12 weeks old when photographed, and 3 to 8 weeks old when infected aphides were placed on them). Primary symptoms are to be seen in plants from 13 to 15 weeks old; no symptoms at all discernible on the oldest (extreme left) series at the date given.

FIG. 2. *Bottom Row (right to left).* Variety "Kerr's Pink," with secondary Leaf-Roll in the three youngest of the series (*i.e.*, plants from 7 to 9 weeks old when photographed, and 3 to 5 weeks old when first infected).

The figures obtained from Row 2 are summarized as follows :—

TABLE III.—COMPARISON BETWEEN SPRAYED AND UNSPRAYED BANDS; SHOWING NUMBER OF WEEVILS FOUND HIBERNATING IN THE BANDS, AND ON THE TRUNKS IMMEDIATELY BENEATH THEM

Treated	*Dead*	*Paralyzed*	*Alive*
Sprayed bands	908	25	189
Sprayed trunks (under band)	270	16	109
Totals	1,178	41	298
Unsprayed bands	32	1	1,025
Unsprayed trunks (under band)	62	Nil	1,558
Totals	94	1	2,583

The number of weevils killed and paralyzed by the spray amounted to 1,219, while 298 appeared to be unaffected by the treatment. It was found, however, that many of the latter group died a few days later. Unfortunately, a detailed record was not kept.

The unsprayed bands and trunks produced 2,583 live weevils and only 94 dead ones.

As before, a large number of weevils were found on the trunks, under the bands, and not on the bands themselves. Also, a greater proportion of the weevils occurred on the unsprayed bands and trunks, and this fact may lead one to suppose that some of the weevils were driven away from the treated bands at the time of spraying.

If this were the case, it is more than likely that a large percentage of these weevils were affected by the spray and subsequently died. It has been pointed out already that the weevils paralyzed by the spray invariably died within a few days; and it was also found that most of the active weevils taken from the sprayed bands did not live more than a few days after examination.

It has been shown in this experiment that a large number of weevils hibernate on the bark, immediately beneath the bands, and not in them. It has been proved that most of these are killed by the spray. If the bands had been removed from the trees and burnt, or treated in some other way, these weevils would have escaped unharmed. Moreover, it must be remembered that many weevils fall to the ground and escape while the bands are being removed, however carefully this operation is conducted.

In practice the weevils can be destroyed by spraying the bands while the routine winter tar-distillate wash is being applied to the trees. It is essential to soak each band thoroughly with the spray. Any spray running down the trunk gets soaked up by the band, therefore a great deal of extra wash need not be used.

In orchards, where young apple trees are staked as a protection against wind, it is usual to place a piece of sacking around the tree trunk, where the stake is tied to the tree, to prevent rubbing and damage by the string. Many weevils hibernate in this type of sacking band and these also are killed by the spray.

Banded trees should be sprayed during December and January, and not later, since it has been demonstrated that the weevils begin to leave the bands during February.*

Up to the present, it has not been proved by experiment that once the sack bands are sprayed with a tar-distillate wash they will continue to be an attractive hiding place for the weevils. Observations made last summer, however, indicated that the Apple Blossom Weevil did not object to shelter in the sprayed bands.

The writers are greatly indebted to Mrs. M. Massee and to Mr. W. Steer for their help and criticism during this investigation.

Summary.—1. It is demonstrated that corrugated cardboard bands may be used instead of, and in preference to, "sack bands" for trapping Apple Blossom Weevils.

2. Strips of carpet felt also proved to be superior to the "sack band" when tested under similar conditions.

3. A new method of destroying the weevil whilst hibernating in the "sack band" is described.

4. It is shown that the weevils can be killed by spraying the bands *in situ* on the trees with a 10 per cent. tar-distillate wash.

5. It is found also that the weevils hibernating on the trunks immediately beneath the bands are destroyed by the wash.

* The Control of the Apple Blossom Weevil. A. M. Massee, *East Malling Res. Stn. Ann. Rep.*, 1924, 25, p. 154.

MAY ON THE FARM

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To the casual observer this is a cheering period ; the countryside assumes a freshness and a sense of newness ; to the farmer it is a period of hope that crops will make rapid and satisfactory growth, that stock will thrive and grow, fatten or produce milk with a minimum of direct expenditure in foodstuffs and with less labour. Warm summer breezes from southerly or westerly points are most welcome, but these are apt to change somewhat suddenly to easterly or north-easterly directions and be of a piercing, and sometimes foggy, nature, indicating that winter has not yet gone from North-West Europe.

Western and southern districts have an advantage at this period, but even there drying winds are often prevalent and it is quite usual for evaporation greatly to exceed the rainfall.

The Use of Grass.—Grass is now the main food for cattle ; the rate of growth is more rapid than at any other season of the year and as much as one quarter of the whole year's growth may take place in six weeks. The young, quick-grown grass is succulent, palatable, digestible and highly nutritious, but very laxative. The problem which faces the farmer is whether, and to what extent, grass should be supplemented with artificial foods. The laxative nature of the grass induces many to use undecorticated cotton cake as a corrective ; such a food has the desired effect, and the high fibre content may delay the passage of the grass through the intestines and allow a greater opportunity for the nutrient materials to be absorbed. Another reason for using supplementary foods is to balance the protein and carbohydrate equivalents ; undecorticated cotton cake is not helpful in this respect, as the young grass itself has a high protein content, much higher than is regarded as a balanced ration. The use of a carbohydrate or cereal food is a more useful supplement to young grass and has been used with considerable success. This is a favourable opportunity to use home-grown cereals with advantage.

The quantity of grass available will also be a determining factor in the use of supplementary foods. If grass is insufficient in amount, supplementary foods would be required to maintain full production ; with excess of grass, foods to correct the high protein content and laxative nature may be used, but it is well worth while to modify and control the grazing area and as soon as possible to reduce the supplementary foods to a minimum. The economic aspect of the utilization of grass deserves more investigation.

Pasture grass is the best of all foods for cattle and sheep during early summer, and it should also be the cheapest. The quality and quantity, as well as the cost, are determined by the quality of the land, the nature of the grass and its treatment and manuring. The value of the grass to the farmer will largely depend on the class of stock using it. Store stock and dry stock appreciate good grass and respond to its influence, but the cash returns per acre will be low as compared with fattening stock, and these in turn may give cash returns below that obtainable from milk producing stock—either ewes nursing lambs or cows producing milk for sale. The higher returns will justify higher expenditure.

Another factor affecting the profitable use of grass is whether grass is the sole food or whether supplementary foods also are given. Grass may be of too high a protein content or it may be too laxative, but the correcting of these properties by supplementary foods means a further outlay and there is no reliable evidence to prove that such foods are profitable, particularly during the early summer months, provided the grass is of average quality and in fair quantity ; indeed, a long series of experiments can be quoted to show how unprofitable supplementary feeding can be. Exceptions may be made where stock are being pushed for a particular early market, or where milk records are desired independent of cost.

The condition of the grass itself is all-important ; leafy herbage is of the greatest value and any tendency to run to seed should be checked by periodical close grazing or, if this is not practicable, by the use of the mower.

Fattening cattle do not respond freely where the grass is short ; high protein content is less important to them than to milk producing animals, and abundant pasture where they can quickly satisfy their requirements suits them best.

Haymaking.—The first crop to be ready for hay in the south is trifolium or crimson clover. This is cultivated mainly as a forage crop for cutting green, but any surplus for this purpose can be made into hay. It is not first class hay, and one may easily err by cutting too late ; it must be cut early. Lucerne in its second or third year is another early crop for haymaking. The appearance of a few flowers is regarded as a sign that lucerne is ready to be cut for hay and it is well to be early.

Cutting early lengthens the time required to dry the hay, but better quality is ensured. The retention of the leaf is important, and the use of modern labour saving machinery is a disadvantage in this respect. The swaths should be turned over when the lucerne is moist with dew, or on a dull day, and within two or three days after cutting should be put into small cocks; these are subsequently increased in size and frequently turned completely over until about 10 days after cutting, when the hay will be fit to stack when dry.

Early cut meadow hay, particularly if the grass has been manured with quick-acting nitrogenous manures, requires time for the grass to "die"; apparent dryness in such young succulent material may be deceptive and lead to overheating if stacked too early.

The practice of haymaking varies according to the humidity of the climate and the moistness of the soils. In the southern and midland counties of England the general practice is to dry the material in the swath or cock to such a state that it can be carted direct to the stack or Dutch barn; a slight sweating or heating is desired so that the hay will go together in such a way as to prevent it subsequently becoming too dry and even brittle and powdery. Excess of sweating causes a loss of nutrient material, and may even give rise to fire by the production of an inflammable gas.

In districts where there is greater dampness and less bright sunshine, haymaking is not practicable so early in the season and the process is modified to suit the conditions. Generally it consists of drying the grass sufficiently to enable it to be stacked in the field in small circular ricks or 'pykes,' each containing about 10 to 15 cwt. In this state it is comparatively safe for a time, and may sweat a little, after which it can be safely stored in large ricks or in Dutch barns. These methods are a good illustration of the adaptation of farm practice to the climatic conditions. The northern methods have been accompanied by the more general use of sheds or Dutch barns for final storage; within recent years Dutch barns have come into more general use in the south, but where hay is made for sale the ricked hay is preferred, possibly because the hay put into Dutch barns has been dried to a greater extent to minimize the risk of fire and does not cut out in so compact a state and with such a good 'nose' as the slightly browned and sweated hay common in ricks.

Tillage Operations.—In the preparations for swedes, turnips and kales it is desirable to aim at a good tilth without undue loss of moisture. On the larger farms, where a number of teams of horses or a tractor may be available, it is possible to concentrate on a relatively small area and complete the formation of tilth in a short time, to be followed by immediate sowing of the seed. Single team farms are at a disadvantage in this respect, and loss of moisture often occurs before a proper tilth can be obtained and the seed sown.

Experience with rotary tillage is still somewhat limited, but the preparation of a tilth at this season of the year would appear to be one of the best opportunities for utilizing this type of cultivation on the general farm. Rotary cultivation has proved a real boon in orchards for the destruction of weeds and the maintenance of a loose mulch, and is also being increasingly applied under market garden conditions. The formation of tilth—'season' as it is called in the south—is difficult to discuss. It is a matter for the right tool at the right time under right conditions—but how are we to define the right conditions for different soils and for different purposes? The good practical cultivator knows how to secure a tilth, and a good gardener excels in this respect, but it is an art guided by almost indefinable rules where experience counts for more than teaching. That rotary cultivation can find a place on the farm there need be little doubt, although at present suitable implements are somewhat costly. Investigations are proceeding at Rothamsted, Wye, and other centres, and in spite of somewhat contradictory results there is no reason to despair of this type of implement finding a place on the farm as a more effective tilth producer than the cultivator and the harrow.

Thinning of Root Crops.—The thinning out or singling of root crops is still mainly a manual operation, although spacing drills and special methods of cross drilling can be adopted to secure bunching, leaving only the actual singling to be done by hand. In the south, turnips—especially late-sown turnips—are sometimes thinned out merely by cross-harrowing, whereas in the north the turnip is singled and hoed with as much care as the south country farmer bestows on his mangold crop.

Kales are sometimes singled, sometimes merely bunched, and in other cases are left as sown thinly in drills; for a heavy yield, and especially where the crop is cut and carted from the field for feeding elsewhere, there are decided advantages in singling the plants, and the wider the spacing the stronger will the individual plants develop.

Swedes and mangolds are universally singled, and there are wide variations in the spacing adopted by individual farmers.

The wider spacing has compensating advantages in the greater size of the individual bulbs, and on good land, or on land in good manurial condition, the wider spacing may give the heavier yield per acre. On the other hand, many farmers on good land deliberately adopt closer spacing in order to grow medium-sized good-quality roots.

Spacing is more important in the case of sugar beet than with any of the other root crops; the compensating advantage of wide spacing is less with this crop than with mangolds and swedes. The number of plants per acre can have a material influence on the weight of beet and of sugar per acre. The space between the rows is controlled by practical considerations, and where horse-hoeing is practised distances of less than 18 in. are inconvenient and distances of over 20 in. are justified only where the land is not very clean or on very heavy soils. The spaces between the plants in the row can vary with the richness of the soil; the poorer soils which would naturally grow the smaller beet should carry the greater number of plants per acre. Spacing between 8 in. and 11 in. may be adopted according to conditions. Whatever space is aimed at, it would be well to make actual counts of what is accomplished; it will generally be found that the desired spacing is exceeded. Sugar beet should be thinned out as soon as four full leaves have developed; at this stage one gets the double advantage of easy and speedy work and better subsequent growth. In every case loose soil should be left round the young plants so as to avoid too rapid drying of the soil and an undue check in growth.

NOTES ON MANURES

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Manures for Sugar Beet.—Growers are agreed that in handling this crop the aim should be to secure as heavy a yield as is consistent with a normal percentage of sugar. The best chance of success lies in selecting the most suitable land for the crop—*i.e.*, a medium soil of good depth and sufficiently provided with lime. The next favourable point would be a dressing of about 10 tons of dung ploughed in in autumn, or failing that a good dressing of dung applied to the previous crop.

Experience has shown that dung alone is not enough and complete fertilizer treatment is required in addition. This will usually form a spring dressing before sowing, but it is permissible to apply potash salts, and in particular the low grade potash salts, in winter, and if basic slag is the form of phosphate chosen this also may be applied at this time. The quantities of fertilizers to use cannot be laid down definitely for all cases, but the following scale of dressings has been found successful in ordinary practice and may serve as a rough guide.

Nitrogen: 23–46 lb. per acre when dung is used, or 58–70 lb. per acre when dung has not recently been given. One hundred weight of sulphate of ammonia or cyanamide provides about 23 lb. N.; 1 cwt. of nitrate of soda or nitro-chalk gives about 18 lb. N. When compared on an equal nitrogen basis nitrate of soda usually does rather better than sulphate of ammonia, but the cost per unit of nitrogen is higher. Cyanamide should be applied a fortnight or so before drilling, and the other nitrogenous manures at drilling time. A frequent practice is to retain half the nitrogenous manure for a top dressing after singling, in which case nitrate is usually given.

Phosphate: 36–54 lb. of phosphoric acid per acre when dung is given, or 54–72 lb. in the absence of farmyard manure. One hundredweight of 35 per cent. superphosphate provides 18 lb. of phosphoric acid. A high soluble basic slag may be used to supply the phosphate, and like superphosphate it is suitable for spring application. It cannot be mixed with sulphate of ammonia, but mixes well with cyanamide.

Potash: 56–84 lb. potash with dung, or 84–112 lb. potash without dung. One hundredweight of muriate of potash contains about 56 lb. of potash. The salt in the low grade potash manures appears to be advantageous for sugar beet,

and it is therefore quite suitable to apply the potash as 20 or 30 per cent. potash salts or as kainit. These low grade manures may be given a few weeks before sowing or even in the previous winter.

An interesting report of the continuation, in 1928, of the sugar beet experiments of the Department of Agriculture of the Irish Free State has been published. The results from 31 centres confirmed the good performance of a mixture consisting of 4 cwt. of superphosphate, 4 cwt. of kainit, and 1 cwt. of sulphate of ammonia when used with dung. This mixture provides about 23 lb. of nitrogen, 72 lb. of phosphoric acid, and 65 lb. of potash per acre. It was not improved by altering the balance of N, P, or K, but, by increasing the total dressing by 25 per cent. and maintaining the above proportions, slightly better results were obtained. Nitrate of soda (1 cwt.), sulphate of ammonia (1 cwt.), and nitro-chalk (equivalent to the sulphate) all behaved very similarly, and if anything the sulphate of ammonia had the preference in the amounts chosen. Doubling the nitrogen produced more leaf but very little more sugar. The report should be studied in detail, but expressing the results of the 31 centres in terms of sugar per acre they come out as follows :—

SUGAR : CWT. PER ACRE. MEAN OF 31 CENTRES, 1928

Basal dressing	*Comparisons*		*Sugar cwt.*
Dung 4 cwt. super 4 cwt. kainit	Sulphate of ammonia	1 cwt.	41·0
	Nitrochalk equivalent		40·6
	Nitrate of soda	1 ,,	39·6
	Sulphate of ammonia	2 ,,	41·0
	Nitrate of soda	2 ,,	40·3
Dung 4 cwt. super 1 cwt. s/a	Kainit	3 cwt.	39·5
	,,	4 ,,	41·0
	,,	5 ,,	40·3
Dung 4 cwt. kainit 1 cwt. s/a	Superphosphate	3 cwt.	38·6
	,,	4 ,,	41·0
	,,	5 ,,	40·3
Dung	Super Kainit S/A	4 cwt. 4 ,, 1 ,,	41·0
	Super Kainit S/A	5 cwt. 5 ,, 1½ ,,	43·2

The value of a top dressing of 1 cwt. of nitrate of soda in addition to the sulphate of ammonia given in the seed bed

had been proved in previous experiments, when the young plant was suffering from unfavourable weather conditions or insect attack.

Manures for Acid Soils.—It may be emphasized that if a soil is strongly acid no treatment short of the addition of lime or chalk in quantity is likely to produce useful results in reasonable time. There are, on the other hand, certain soils which, without being in the above class, are so near the acid side that systematic fertilizer treatment may either make them acid on the one hand or delay the onset of acidity on the other. Those who find themselves farming such soils might make a small-scale trial with basic slag as a source of phosphate and calcium cyanamide as a source of nitrogen. The basic slag might be of low grade because, in order to secure enough phosphate, a heavy dressing would be necessary, containing a larger weight of lime equivalent. One can assume as a rough guide that one-third of the weight of slag used is quicklime. This is not strictly true, but the basic constituents of the slag would operate in much the same way as an amount of lime so calculated. Cyanamide contains rather more than one-half its weight of lime equivalent. The above two fertilizers mix well, and, if it is required to make up a complete fertilizer, muriate of potash may be used with them, in which case it is a safeguard to make up the mixture shortly before it is to be applied. For top dressings of quick-acting nitrogen on the above class of land the nitrates of soda or of lime, or the newer product nitro-chalk, should be given a trial.

On light soils of rather acid character, neutral or slightly basic phosphate, such as steamed bone flour, basic superphosphate or precipitated phosphate (*i.e.*, di-calcium phosphate), are sometimes used as an alternative to superphosphate. It would be an inexpensive and useful experiment to test the action of the very finely ground mineral phosphates now being turned out as a source of phosphoric acid on these soils.

The alternative to the above methods would be to apply about half a ton of ground quicklime once in the autumn and this might give complete freedom of choice in the matter of artificials.

Nitrogen on Barley.—Determination of the nitrogen in the grain of barley, grown with and without nitrogenous fertilizers over a series of years at Rothamsted, has shown that, in years when the manures produce their usual increase in yield, the percentage of nitrogen in the grain is not appreciably raised and may in fact be lowered. The reason for this is that the

increase in carbohydrates formed in the plant compensates for the extra nitrogen provided by the manure and taken up from the soil. In unfavourable seasons sufficient carbohydrate may not be produced to balance the nitrogen absorbed and a high percentage of nitrogen may be stored up in the grain with consequent lowering of malting quality. If the percentage of nitrogen is high even on the samples which received no nitrogenous fertilizer, the addition of nitrogen can do no harm, for it may produce more grain and the sample would be of feeding value in any case. Indeed the extra protein in a feeding sample is an advantage. The following figures from Rothamsted illustrate these points :—

Year	*Nitrogen in grain, per cent.* No Nitrogen	*Nitrogen in grain, per cent.* With Nitrogen	*Increase for 1 cwt. sulphate of ammonia bush. per acre*
1925	1·60	1·59	6·0
1926	1·60	1·71	—3·4
1927	1·45	1·44	10·4
1928	1·92	2·02	7·0

The seasons 1925 and 1927 gave normal responses to nitrogenous fertilizers and the barley contained a medium percentage of nitrogen which was not raised by the nitrogenous manuring. The season 1926 was unusual in the fact that sulphate of ammonia appeared to depress the crop, while the percentage of nitrogen was raised ; and in 1928, when a sample high in nitrogen and unfit for malting was grown without sulphate of ammonia, the addition of sulphate of ammonia gave a higher yield and at the same time further increased the nitrogen in the grain, but this was of no consequence under the circumstances.

A series of figures showing similar features has recently been published in Germany.* In English measure they are :—

Year	*Nitrogen in grain, per cent.* No Nitrogen	*Nitrogen in grain, per cent.* With Nitrogen	*Increase for sulphate of ammonia bush. per acre*	*Sulphate of ammonia applied lb. per acre*
1924 ..	1·34	1·41	19·4	130
1925 ..	1·92	2·46	8·4	175
1926 ..	1·44	1·34	20·0	220

The amounts of nitrogen given were on the whole greater than in the English experiment above, hence the higher yield increases. The years 1924 and 1926 with these high responses

* *Zeitschrift für Pflanzenernährung u. Düngung*, Vol. IX., 1930, pp. 35–43.

to nitrogenous manuring show little effect on the quality of the grain as measured by the percentage of nitrogen. In 1925, a very hot dry year, the yield increases were smaller, and the nitrogen was high in any case and was markedly increased by the use of sulphate of ammonia.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended April 16. Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) .. *	10 2*d*	10 2*d*	10 2*d*	10 2*d*	13 0
Nitro-chalk (N. 15½%) .. *	9 19*d*	9 19*d*	9 19*d*	9 19*d*	12 10
Sulphate of ammonia :— Neutral (N. 20·6%) .. .. *	10 2*d*	10 2*d*	10 2*d*	10 2*d*	9 10
Calcium cyanamide (N. 20·6%) *	9 6*e*	9 6*e*	9 6*e*	9 6*e*	9 0
Kainit (Pot. 14%) .. .. §	3 6	2 19	2 19	3 3	4 6
Potash salts (Pot. 30%) .. §	5 3	4 18	5 0	4 19	3 4
,, (Pot. 20%) .. §	3 15	3 9	3 8	3 11	3 7
Muriate of potash (Pot. 50%) §	9 17	9 3	9 2	9 5	3 8
Sulphate,, ,, (Pot. 48%) §	11 19	11 6	11 5	11 5	4 8
Basic Slag (P.A. 15¾%)‖ .. §	2 13*c*	2 3*c*	..	2 9*c*	3 1
,, (P.A. 14%)‖ .. §	2 7*c*	1 16*c*	1 16*c*	2 3*c*	3 2
,, (P.A. 11%)‖ .. §	..	1 9*c*	1 9*c*	..	..
Ground rock phosphate (P.A. 26-27½%)‖ .. .. .. §	2 2*a*	2 10*a*	2 5*a*	2 2*a*	1 7
Superphosphate (S.P.A.16%).. §	3 11	..	3 9	3 6	4 2
,, (S.P.A.13½%).. §	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3¾%, P.A.20½%) §	8 15	8 10	8 12	7 15	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%) .. .. §	5 17*b*	..	6 10	4 15	..

Abbreviations : N. = Nitrogen ; P.A. = *Phosphoric Acid* ; S.P.A. = Soluble Phosphoric Acid ; Pot. = Potash.

* Prices are for not less than 6-ton lots, *for delivery* during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, nett cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 80% through standard sieve. *a* Prices for 6-ton lots f.o.r. at makers' works.

b *Delivered* (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots ; at Bristol, f.o.r. Bridgwater ; at *Hull* and *Liverpool*, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1*s.* per *ton* extra and for lots of 2 tons and under 4 tons 5*s.* per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

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NOTES ON FEEDING STUFFS

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Early Maturity.—Farmers of to-day owe a great debt to their forerunners of the last two centuries who took such trouble, and showed so much skill, in improving farm livestock. The type of animal that formed the raw material of those great pioneers (Bakewell and those on whom his mantle fell) would spell nothing but ruination for the farmer who owned it nowadays. Cattle used not to be ready for the butcher until they were five years old, or even more, and such animals would be an impossible proposition at the present day, when an age of three years at killing is hardly economic, and when more and more farmers are trying to get them fat much earlier as baby beef. The most cursory survey of the trends during the last hundred years suffices to show that what has been most strenuously and successfully sought in the past, and what is most desirable now, and will be imperative in the future, is early maturity. It might therefore be well to note briefly what progress in this direction really entails.

Early maturity connotes not only weight for age, but also the attainment early in life of what the butcher regards as "quality"; this latter is of great importance, for the one thing in which home-produced meat has a definite advantage over the imported article is in quality, and this alone enables it to compete more or less successfully with cattle raised under extensive systems of agriculture. Since home-killed meat has a higher quality than imported it normally commands a higher price, and so finds its way to the butchers who sell to relatively wealthy (or discriminating) customers. These butchers have very little use for the second quality cuts—their ideal animal contains a very high proportion of the better joints such as loin and round.

As an animal gets older it goes through a series of changes in the proportions of its body—and not all parts grow at the same rate; so that the shape at maturity differs considerably from the shape at birth. The most striking peculiarity of the new-born animal is that it is "all head and legs," being decidedly lacking in length and depth of the body. Thereafter the head and legs grow relatively very little, whilst the depth and length (particularly) of the body grow rapidly. Further, the length keeps on increasing after the other dimensions have practically reached their final shape. The following figures will serve as an example: they were actually obtained from

Dairy Shorthorns, but, as they refer only to bone lengths, they will suffice to bring out these points. The measurements of new-born calves are the average for 12, measured within a month of birth, those at first calving (average age 35 months) are the average of 84 heifers, whilst the figures for mature cows are very rough and based only on a few. (All the measurements are in centimetres.)

	Birth.	*First Calving.*	*Mature Cow.*
Shoulder Height	76cm.	130 cm.	131½ cm.
Back Length	64 ,,	139 ,,	154 ,,
Length of Foreleg ..	50 ,,	74 ,,	74 ,,
Leg Length : Shoulder Height	0·66 : 1	0·57 : 1	0·56 : 1
Back Length : Leg Length	1·28 : 1	1·88 : 1	2·08 : 1

It will be seen that from birth onwards the leg accounts for less and less of the total height, sinking from 66 per cent. to 56 per cent. of it: but the greater change is in the ratio between the length of the body and the length of the leg, which rises from 1·28 to 1·88 at first calving and 2·08 at maturity. As an animal gets older, therefore, it improves in quality: its head and legs, and, in general, the second class joints, grow relatively slowly and so form a lower proportion of its total weight, whilst the length increases rapidly and so the best cuts come to form a larger proportion of the body.

Mr. Hammond has studied the changes of shape with age extensively, and, by reproducing photographs so that the height at the shoulder is the same in all cases, has illustrated them very clearly. It is interesting to compare the various breeds of sheep in this way, and to compare any of our improved races with the wild sheep: all of them go through the same changes of shape, but the improved breeds have been selected so that they pass more rapidly through these changes and so attain a higher quality at a younger age. To take the extreme case, Mr. Hammond's photographs show that our present day sheep has as high a quality (that is, a high proportion of first class joints) at birth as the wild sheep ever reached even when fully mature. As the modern sheep gets older, of course, it improves still further, eventually attaining a condition when the proportion of high class meat is very much higher than it would ever be in the wild sheep.

So far only the relations between the rates of growth of the different parts of the body framework have been considered, but this does not account for all the differences between the bodies of young and mature animals. One of the chief im-

seem that this whole trend must be in the right direction as leading to greater efficiency in the conversion of foodstuffs into meat, but success depends on the animal taking kindly to having the age changes in the proportions of its body hastened. Fundamentally, therefore, the progress of the movement rests on successful breeding for early maturity: as this is achieved the economic possibility of exploiting it to the full, by high feeding all the way from birth to slaughter, will also be increased.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	5 16
Maize	81	6·8	7 1
Decorticated ground nut cake	73	41·0	8 5
" cotton cake	71	34·0	10 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·65 shillings, and per unit protein equivalent, 1·96 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES.

Crops	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	6 18
Oats	60	7·6	5 14
Barley	71	6·2	6 9
Potatoes	18	0·6	1 11
Swedes	7	0·7	0 13
Mangolds	7	0·4	0 12
Beans	66	20·0	7 8
Good meadow hay	37	4·6	3 10
Good oat straw	20	0·9	1 15
Good clover hay	38	7·0	3 16
Vetch and Oat silage	13	1·6	1 5
Barley Straw	23	0·7	1 19
Wheat straw	13	0·1	1 2
Bean straw	23	1·7	2 1

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d. net.

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	8 5	0 12	7 13	72	2 1	1·12	9·6
Barley, British feeding ..	—	—	6 15	0 9	6 6	71	1 9	0·94	6·2
" Canadian feed	19 0	400	5 7*	0 9	4 18	71	1 5	0·76	6·2
" Danubian	22 0	"	6 3	0 9	5 14	71	1 7	0·85	6·2
" Persian	19 0	"	5 7	0 9	4 18	71	1 5	0·76	6·2
" Syrian	22 0	"	6 3§	0 9	5 14	71	1 7	0·85	6·2
" Tunisian	22 0	"	6 3§	0 9	5 14	71	1 7	0·85	6·2
Oats, English, white	—	—	6 0	0 10	5 10	60	1 10	0·98	7·6
" " black and grey	—	—	6 5*	0 10	5 15	60	1 11	1·03	7·6
" Argentine	16 0	320	5 12	0 10	5 2	60	1 8	0·89	7·6
" Chilian	17 0	"	5 18	0 10	5 8	60	1 10	0·98	7·6
" German	18 6	"	6 10	0 10	6 0	60	2 0	1·07	7·6
Maize, Argentine	28 9	480	6 13	0 10	6 3	81	1 6	0·86	6·8
" South African	32 0	"	7 10§	0 10	7 0	81	1 9	0·94	6·8
Beans, English winter ..	—	—	7 10†	1 4	6 6	66	1 11	1·03	20
" Chinese	—	—	9 15§	1 4	8 11	66	2 7	1·38	20
Peas, English blue	—	—	8 12†	1 1	7 11	69	2 2	1·16	18
" Japanese	—	—	15 10§	1 1	14 9	69	4 2	2·23	18
Dari	—	—	8 0†	0 11	7 9	74	2 0	1·07	7·2
Milling offals—									
Bran, British	—	—	4 17	1 1	3 16	42	1 10	0·98	10
" broad	—	—	6 0	1 1	4 19	42	2 4	1·25	10
Middlings, fine, imported ..	—	—	6 0	0 17	5 3	69	1 6	0·80	12
" coarse, British ..	—	—	5 0	0 17	4 3	58	1 5	0·76	11
Pollards, imported	—	—	4 10	1 1	3 9	60	1 2	0·62	11
Meal, barley	—	—	7 0	0 9	6 11	71	1 10	0·98	6·2
" maize	—	—	7 5	0 10	6 15	81	1 8	0·89	6·8
" " South African ..	—	—	6 15	0 10	6 5	81	1 7	0·85	6·8
" " germ	—	—	6 15	0 15	6 0	85	1 5	0·76	10
" locust bean	—	—	8 5	0 7	7 18	71	2 3	1·20	3·6
" bean	—	—	10 0	1 4	8 16	66	2 8	1·43	20
" fish	—	—	19 0	3 3	15 17	53	6 0	3·21	48
Maize, cooked flaked	—	—	8 15	0 10	8 5	83	2 0	1·07	8·6
" gluten feed	—	—	7 17§	0 19	6 18	76	1 10	0·98	19
Linseed cake, English, 12% oil	—	—	11 12	1 9	10 3	74	2 9	1·47	25
" " " 9% "	—	—	10 15	1 9	9 6	74	2 6	1·34	25
" " " 8% "	—	—	10 10	1 9	9 1	74	2 5	1·29	25
Soya bean cake, 5½% oil ..	—	—	8 12*	2 0	6 12	69	1 11	1.03	36
Cottonseed cake—									
English, 4½% oil	—	—	5 15	1 7	4 8	42	2 1	1·12	17
" " Egyptian, 4½% "	—	—	5 7	1 7	4 0	42	1 11	1·03	17
Decorticated cottonseed meal, 7% oil	—	—	10 0*	2 0	8 0	74	2 2	1·16	35
Ground-nut cake, 6-7% oil ..	—	—	7 0†	1 7	5 13	57	2 0	1·07	27
Decorticated ground-nut cake, 6-7% oil	—	—	8 5†	2 1	6 4	73	1 8	0·89	41
Palm kernel cake, 4½-5½% "	—	—	6 15†	0 17	5 18	75	1 7	0·85	17
" " " meal, 4½% "	—	—	7 5†	0 17	6 8	75	1 8	0·89	17
" " meal 1-2% oil ..	—	—	6 5†	0 18	5 7	71	1 6	0·80	17
Feeding treacle	—	—	6 7	0 9	5 18	51	2 4	1·25	2·7
Brewers' grains, dried ale ..	—	—	5 7	0 17	4 10	48	1 11	1·03	13
" " " porter	—	—	5 0	0 17	4 3	48	1 8	0·89	13
Malt culms	—	—	7 10§	1 6	6 4	43	2 11	1·56	16

* At Bristol. † At Hull. § At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of March and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £9 per ton, then since its manurial value is 17s. per ton as shown above, the food value per ton is £8 3s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 2d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·16d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N 9s. 6d.; P_2O_5, 3s. 2d.; K_2O, 3s. 4d.

provements in the quality as age increases is that, relatively speaking, all the bones grow less rapidly than the other tissues, so that the mature animal contains a greater proportion of lean meat and fat to bone than does the young one. If we take the animal from its conception, through its fœtal life, and on until it is in the adult state, three stages may be noticed : (1) the bony framework is set up (as we have seen at very different rates in different parts of the body), (2) then the muscle (lean meat) is put on, and (3) finally, when the demands for these have been met, fat is stored up. Naturally the three processes overlap considerably, but a succession of phases of growth of this sort can be detected. To get really good meat the third stage must be reached, as the fat makes the meat more tender and helps to balance it up as a food, so that early maturity means much more than large weight at an early age.

Primarily, what is wanted is an animal that passes rapidly through the changes which must inevitably come, and so reaches the condition where its carcass yields a high proportion of edible food whilst still comparatively young. The judging of animals for early maturity consists in considering the proportions between the various parts of the body, relative to its size. There are, of course, other points to be considered in breeding animals for meat production, particularly in regard to the fat distribution : some are liable to lay down large masses of fat on and around the gut, which is not eaten and so is very wasteful, whilst others are prone to form masses of fat in patches. What is required is an even distribution, the fat not being too thick in any one place. This is particularly the case with bacon pigs, one of the chief faults to be guarded against here being very thick back fat, and particularly large lumps over the shoulder. The state of fatness that should be reached is what is usually described as marbling. This means that fat is laid down in between the little bundles of muscle fibres, this having a large effect in making the meat tender: as the fattening proceeds the percentage of dead weight to live weight increases.

The production of high-grade meat animals, however, is not entirely a matter of breeding : that will provide suitable stock to work with, but the full exploitation of them depends largely on feeding. High feeding has the same effect that generations of careful breeding had, in that it also hastens the changes in conformation : underfeeding, on the other hand, affects the later developing (that is in the more desirable) parts of the body first, and so tends to produce a low grade animal. One may

commonly see half-starved cattle of 2½ years old showing body proportions which would be no credit to animals of 18 months or less—in fact they tend to resemble their unimproved ancestors.

There is clearly much to be said in favour of baby beef production : it eliminates the long store period when food consumed is very little more than that required for maintenance, so that practically no return is made for it, and it means that during the animal's life a lower proportion of its food intake is used merely for maintenance. At the same time the economic possibility of baby beef depends on the work of the breeder, for it cannot be produced with unsuitable animals : it necessitates the demands for maintenance, growth and fattening being met at the same time, and this is only possible with animals which have early maturity carefully bred into them. Even with these it needs much concentrated food, which is expensive, so that success at the present time probably depends on getting an increased price for the product.

Wood and Newman calculated that a 3-year-old bullock should give 800 lb. of saleable meat, whilst a baby beef animal at 18 months old should provide 600 lb. The amount of food (dry weight) that would be consumed in the former case would be 22½ lb. for every 1 lb. of meat, whilst in the latter it would be only 11¾ lb. This shows a very distinct advantage in favour of baby beef—in fact almost a 50 per cent. saving. The same authorities, however, also pointed out that the food per lb. of meat would have to include 2½ lb. of concentrates in the case of baby beef compared with 1¼ lb. for the 3-year-old bullock. When it is considered that much of the concentrated part of the ration is usually purchased (principally to include sufficient protein) it will be realized that the case for baby beef is markedly weakened. Much coarse food must be produced on farms, and the present methods of bullock feeding provide a means of utilizing it, but cheaper concentrates and better pastures would much stimulate baby beef production.

Baby beef is, of course, more tender than that obtained from older animals, but it is apt to lack flavour and an attractive colour for selling purposes. On the other hand, with a falling human birth-rate, the smaller families of to-day and to-morrow need smaller joints, and this demand is admirably met by baby beef. Compared with the not too distant past the present day beef animals of 2½ to 3 years are baby beeves, and it is not very rash to prophesy that the baby beeves of to-day will be the normal supply of meat in the future. It would certainly

MISCELLANEOUS NOTES

Composition of Some Rabbit Carcasses

IN the article on "The Composition of Some Rabbit Carcasses," which appeared in the March, 1930, issue of this JOURNAL (p. 1203) the imports of rabbit flesh into the United Kingdom during 1926 were inadvertently stated to be 266,712 tons, instead of 266,712 cwt. The declared value was £768,859, as given in the article. The corresponding figures for 1929 are 243,934 cwt. and value, £744,335.

* * * * * *

The Agricultural Index Number

THE index number of the prices of agricultural produce during March was 39 per cent. above the base years 1911-13, as compared with 44 per cent. a month earlier. Over the corresponding period last year, the index figure declined by one point to 43 per cent. above pre-war. Most commodities became cheaper during the month under review, and even in the comparatively few instances in which increases in price occurred, these were proportionately less pronounced as a rule than in the base years.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	—
May	57	50	42	54	44	—
June	53	48	41	53	40	—
July	49	48	42	45	41	—
August	54	49	42	44	52	—
September	55	55	43	44	52	—
October	53	48	40	39	42	—
November	54	48	37	41	44	—
December	54	46	38	40	43	—

Grain.—Prices of grain continued to fall during March, wheat declining by 8d. per cwt., and barley and oats by 4d. and 6d. respectively. In the case of wheat, the index figure was 9 points lower at 12 per cent. over the 1911-13 level, while the indices for barley and oats fell by 2 and 7 points respectively to 2 and 15 per cent. below pre-war prices. As

compared with a year ago, wheat was cheaper by 1s. 4d. per cwt., barley by 2s. 5d. and oats by 3s. 8d.

Live Stock.—Quotations for fat cattle rose slightly during the month, but as the rise was proportionately the same as that which occurred between February and March of the base years, the index number showed no change at 37 per cent. above the base level. Fat sheep sold at about the same prices as in February, but the index figure declined by 4 points to 52 per cent. over pre-war. The rise in values for fat pigs, which had continued without interruption since October of last year, received a check; baconers were practically unaltered on the month, but porkers became slightly cheaper, the index numbers declining by 5 and 3 points respectively to 90 and 96 per cent. in excess of the 1911-13 levels. Quotations for dairy cows were again reduced and the index figure was one point lower at 30 per cent. over pre-war. Store cattle were a little dearer, but the index was unchanged at 26 per cent. above the base period. The rise of nearly 2s. per head in store sheep prices was insufficient to prevent the index number falling by one point, a rather more pronounced increase having taken place between February and March of 1911-13. Similarly, although values for store pigs appreciated slightly the index dropped by 10 points to 125 per cent. above pre-war.

Dairy and Poultry Produce.—Milk during March was on average about 1¼d. per gallon cheaper than in February, and the index figure was reduced by 12 points to 55 per cent. above the base level, but cheese became rather dearer at 40 per cent. over pre-war. Butter prices were again lower at 37 per cent. above 1911-13, while eggs were much cheaper, the reduction in March amounting to about 7½d. per dozen and 20 points in the index number as compared with a reduction of 3¼d. in the corresponding period of 1929. Fowls were a little dearer at 41 per cent. over 1911-13, the figure for poultry as a whole being 52 per cent.

Other Commodities.—Prices of potatoes continued to fall during March and the price level was 10 points lower at 24 per cent. under pre-war. Between February and March, 1929, the index for potatoes appreciated by 11 points to 40 per cent. above pre-war. Green vegetables mostly became rather dearer on the month, but root vegetables were reduced in price as a rule, the composite index number for vegetables being calculated at 66 per cent. above 1911-13 as compared with 44 per cent. in February. Both clover and meadow hay were somewhat cheaper, but as the downward movement in

the base years was more acute in the case of meadow hay, the index number for this description showed a rise of 2 points. The combined index for hay was unaltered, however, at 34 per cent. above 1911-13. Prices of wool were further reduced on the month and the index number was 7 points lower at 11 per cent. above pre-war.

Index numbers of different commodities during recent months and in March, 1928 and 1929, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13.

Commodity	1928	1929		1930		
	Mar.	Mar.	Dec.	Jan.	Feb.	Mar.
Wheat	30	30	28	30	21	12
Barley	36	28	7	7	Nil	—2*
Oats..	49	36	2	1	—8*	—15*
Fat cattle	38	33	30	38	37	37
Fat sheep	61	52	53	67	56	52
Bacon pigs	40	58	64	90	95	90
Pork pigs	45	66	77	98	99	96
Dairy cows..	31	30	31	33	31	30
Store cattle..	23	22	17	25	26	26
Store sheep..	47	56	48	55	49	48
Store pigs	35	57	108	137	135	125
Eggs	26	93	47	40	51	31
Poultry	40	40	34	44	41	52
Milk	56	60	67	67	67	55
Butter	47	54	45	44	43	37
Cheese	65	74	32	37	39	40
Potatoes	82	40	10	—4*	—14*	—24*
Hay	12	7	41	38	34	34
Wool	70	60	39	32	18	11

* Decrease.

* * * * * *

Trials of Potatoes for Immunity from Wart Disease, 1929

THE trials which are arranged each year by the Ministry, with the object of testing new varieties of potatoes for immunity from Wart Disease, were again conducted in 1929 on the farm of the National Institute of Agricultural Botany, Ormskirk, Lancashire. The actual field operations and the taking of records were carried out by Mr. Harold Bryan, B.Sc., and Mrs. McDermott, of the Institute, but the trials were conducted on a plan approved by the Ministry.

Forty-seven stocks were included in the second and subsequent years' tests, and all remained immune from Wart

Disease. Of the 62 entries for the first year's tests, 2 became infected in the field ; 9 proved to be synonyms of existing varieties ; 5 were too mixed or too poor to judge ; and 48 were distinct varieties.

As in previous years, the results of the trials have been considered by a small committee composed of representatives of the Ministry, the Department of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland, and co-ordinated with the results of the trials carried out by the two last Departments at Philpstoun and Kilkeel, respectively.

The Committee recommended the approval of 31 new varieties, but only 3 of these have actually been added to the approved list. In the remaining cases inclusion has been postponed until the raisers have intimated that the varieties have actually been or will shortly be introduced into commerce. Descriptions are given below of the 3 new varieties, together with that of one variety which was approved as the result of the 1926 trials and which is now being introduced into commerce.

The findings of the Potato Synonym Committee of the National Institute of Agricultural Botany have been accepted by the Ministry where recommendations as to the classification of new varieties as synonymous with existing varieties have been made by that Committee.

A list of the names of varieties which have been approved in recent years as immune from Wart Disease, and of the older approved immune varieties which are known to the Ministry to be in general cultivation in England and Wales, may be obtained on application to the Ministry.

EARLY VARIETIES

"Devonia"

Sprout .. Pink.

Tuber .. Kidney ; skin white ; flesh white ; eyes shallow.

Haulm and Foliage Dwarf, spreading ; typical early type ; leaflets drooping, soft, flat ; terminal leaflets large ; secondary leaflets small and inconspicuous ; midribs of primary leaflets tinged pink in early stages of growth ; wings straight ; leaf fairly close.

Flowers .. None observed.

"Forerunner"

Sprout .. Pale pink.

Tuber .. Oval ; skin white ; flesh white ; eyes shallow.

Haulm and Foliage Low-growing, open and spreading ; stems non-branching ; leaf open, rigid, long ; leaflets ashy to dark green, dull, rounded.

Flowers .. Absent.

SECOND EARLY VARIETY
"The Director"

Sprout	Pink.
Tuber	Round, flattish; skin white; flesh white; eyes shallow.
Haulm and Foliage	Open, upright, moderately vigorous; leaflets medium green, long, hard, wrinkled; terminal leaflet markedly drooping; secondary leaflets large; leaf close; stem tinged faint pink; wings serrated.
Flowers	Reddish purple, edged white; small; infrequent.

EARLY MAINCROP VARIETY
"Strathbogie Queen"

Tuber	Round; skin white; flesh white; eyes shallow.
Foliage	Haulm of medium height, spreading; leaf open; leaflets medium green.
Flowers	Not observed.

Basis for Redemption of Tithe Rentcharge.—An announcement has been issued by the Minister that, for the purpose of the redemption of tithe rentcharge, for which application is made after March 31, 1930, until further notice, the compensation for redemption will be twenty-two times the net amount of the tithe rentcharge after the deductions prescribed by the Tithe Acts, 1918 and 1925, have been made.

Leaflets issued by the Ministry.—Since the date of the list given in the January, 1930, number of this JOURNAL, p. 1017, the following leaflets have been issued :—

New :—
No. 39. Fowl Typhoid.
No. 99. The Greenhouse Red Spider.
Revised :—
No. 21. The Warble Fly.
No. 31. The Onion Fly.
No. 92. Bunt and Smut in Wheat.
No. 197. Agricultural Education in England and Wales.
No. 394. Phosphatic Fertilizers.
Re-written :—
No. 8. Assessments to Local Rates.
Re-issued :—
No. 342. The Management of Bulls.
Amended :—
No. 11. Daddy Longlegs or Crane Flies.
No. 149. Bacillary White Diarrhoea of Chicks.
No. 319. Apple Capsids.

A single leaflet is supplied by the Ministry, on request, free of charge. If more than one leaflet is required a charge at the rate of 1d. each or 9d. per dozen is made.

Brewing Research.—In the issue of this JOURNAL for August, 1929, an article on "The Research Scheme of the Institute of Brewing" was published, which gave a résumé of the work undertaken by the Institute and indicated the mutual interest of the farmer and the brewer in the scheme. The Institute has now issued a Synopsis of the Research Work of the Institute for 1930. The work includes the development of new

varieties of barley, work on hops from the point of view of their preservative value, and the breeding and cultivation of new varieties as well as on their drying and packing, manuring and diseases. These lines of research are, of course, of direct interest to the farmer because their results will enable him to make the best selection of varieties for heavy yield, freedom from disease and suitability for the market, but in addition to this work, the Institute is engaged upon research into the various technical and engineering problems involved in the process of brewing. Copies of the pamphlet can be obtained from the Secretary to the Institute, Mr. W. H. Bird, F.C.I.S., Brewers' Hall, Addle Street, London, E.C.2.

Medal for "Agricultural Research."—The Ministry has received the following intimation from the Royal Agricultural Society of England, 16 Bedford Square, London, W.C.1 :—

The Council desire to call attention to the offer by the Society of a MEDAL for original agricultural research, the Regulations governing which are as follows :—

(1) The Medal shall be called the *Royal Agricultural Society of England's Research Medal*. The Medal will be of Silver, and money or books to the value of Ten Pounds will be added.
(2) The Medal shall be awarded for a Monograph or Essay giving evidence of original research on the part of the candidate on any agricultural subject, on any of the cognate agricultural sciences or on agricultural economics. It must be signed by the candidate as the genuine work of the candidate himself.
(3) Candidates for the Medal must reside in Great Britain or Ireland, and must not be more than thirty years of age on September 29, 1930.
(4) The Medal shall be adjudged by referees appointed by the Council of the Royal Agricultural Society.
(5) The Monograph or Essay shall be forwarded to the Secretary of the Royal Agricultural Society or on before October 31, 1930. The Monograph or Essay shall be typewritten or printed.
(6) If, in the opinion of the Referees, no Monograph or Essay be found to attain a sufficient standard of excellence, they shall be at liberty to reserve the Medal of that year for award as an additional Medal in some subsequent year.
(7) The Monograph or Essay of the successful candidate shall be published in the JOURNAL of the Royal Agricultural Society if, in the opinion of the Council, it is suitable for that purpose. Essays already published shall not be eligible for the Medal.

Foot-and-Mouth Disease.—The position as this issue goes to press remains as stated in the April issue of this JOURNAL, viz., that no case of foot-and-mouth disease has been confirmed in any part of Great Britain since that at Goring-by-Sea, Worthing, West Sussex, on December 23, 1929.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Cheshire : Miss E. M. Wheeler, B.Sc., N.D.D., has been appointed Assistant Instructress in Dairying.

Oxfordshire : Miss C. Graham, N.D.D., has been appointed Chief Instructress in Dairying and Poultry-keeping.

Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on March 18 and April 8, 1930, at 7 Whitehall Place, London, S.W. 1, Mr. W. B. Yates, C.B.E., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying into effect the Committees' decisions.

Devonshire.—An Order to come into operation on March 26 (when the existing rates were due to expire) fixing minimum and overtime rates of wages to continue in force until March 25, 1931. The minimum rate in the case of male workers of 21 years of age and over is 32s. 6d. per week of 43 hours in the week in which Good Friday falls, 52 hours in any other week in summer, 32 hours in the week in which Christmas Day and Boxing Day fall and 50 hours in any other week in winter, with overtime at 8½d. per hour on weekdays and 10d. per hour on Sundays and for overtime employment on the hay and corn harvests. In the case of female workers of 20 years of age and over the minimum rate is 5d. per hour for all time worked.

Essex.—An Order continuing the operation of the existing minimum and overtime rates of wages from April 20, 1930, when the existing rates are due to expire until April 4, 1931. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 41½ hours in the weeks in which Easter Monday and Whit Monday fall; 50 hours in any other week in summer; 39½ hours in the week in which Christmas Day falls and 48 hours in any other week in winter, with overtime at 9d. per hour on weekdays (including Easter Monday and Whit Monday) and 10d. per hour on Sundays and on Christmas Day. The minimum rate in the case of female workers of 21 years of age and over is 5½d. per hour for all time worked.

Herefordshire.—An Order cancelling the existing minimum and overtime rates of wages as from April 30, 1930, and fixing fresh rates in substitution therefor to come into operation on May 1, 1930, and to continue in force until April 30, 1931. The minimum rate in the case of bailiffs, waggoners, stockmen and shepherds of 21 years of age and over is 36s. per week for all time necessarily spent on the immediate care of animals not exceeding 60 hours, with overtime at 9d. per hour except for employment on Christmas Day and Good Friday where the worker has completed less than 60 hours in the week, when the overtime rate is 2d. per hour. In the case of other male workers of 21 years of age and over the minimum rate is 31s. per week of 44½ hours in the week in which Good Friday falls, 54 hours in any other week in summer, 39½ hours in the week in which Christmas Day falls and 48 hours in any other week in winter with overtime at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate of 4½d. per hour with overtime at 6d. per hour except for employment on Christmas Day and Good Friday where a whole-time worker has completed less than 46½ hours in the week, when the overtime rate is 1½d. per hour.

Lancashire.—An Order to come into operation on May 1, 1930 (*i.e.*, the day following that on which the existing rates are due to expire), and to continue in force until April 30, 1931. The minimum rates in the case of male workers of 21 years of age and over are—in the Southern area for stockmen and teamsmen 37s. per week of 52½ hours, for other male workers 33s. 6d. per week of 50 hours; in the Eastern area 41s. (instead of 42s. as at present) per week of 60 hours for all classes of male workers, and in the Northern area for stockmen and teamsmen, 40s. per week of 60 hours, and for other male workers, 37s. 6d. per week of 60 hours. Overtime is payable in all three areas at 10d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour for all time worked. Under the terms of this Order the Borough of Chorley, the Urban Districts of Adlington and Withnell and the Parishes of Anderton, Brindle, Clayton-le-Woods, Cuerden, Duxbury, Heapey, Heath Charnock, Hoghton, Wheelton and Whittle-le-Woods have been transferred from the southern to the eastern area.

Northumberland.—An Order to come into operation at noon on May 13, 1930 (when the existing rates are due to expire), and to continue in force until noon on May 13, 1931. The minimum rates in the case of male workers of 21 years of age and over are, for horsemen, cattlemen, stockmen and shepherds hired by the week or longer period, 39s. in the case of householders and 36s. in the case of workers who are not householders, these rates being payable in respect of a week of the customary hours not exceeding 62. In the case of other male workers (except casual workers) of 21 years of age and over the minimum rate is 32s. per week of 52½ hours in summer and 48 hours in winter. In the case of casual workers of 18 years of age and over the minimum rate is 7½d. per hour. The overtime rates for all classes of male workers, other than casual workers, are one and a-quarter times the general minimum time rate on weekdays and one and a-half times the general minimum time rate on Sundays. In the case of female workers of 18 years of age and over the minimum rates are 5d. per hour except for casual workers, the rate for whom is 3d. per hour, overtime being payable in each case at 1d. per hour more than the general minimum time rate.

Sussex.—An Order continuing the operation of the existing minimum and overtime rates of wages from April 13, 1930 (*i.e.*, the day following that on which the existing rates were due to expire), until March 29, 1931. The minimum rate in the case of horsemen, stockmen, cowmen and shepherds of 21 years of age and over is 36s. per week of 50 hours in the weeks in which Good Friday, Whit Monday and Christmas Day fall and 58 hours in any other week. The minimum rate in the case of other classes of male workers of a similar age is 31s. per week of 44 hours in the weeks in which Good Friday and Whit Monday fall; 52 hours in any other week in summer; 40 hours in the week in which Christmas Day falls and 48 hours in any other week in winter, the overtime rates being 9d. per hour on weekdays and 10½d. per hour on Sundays, in the case of all classes of male workers. The minimum rate for female workers of 18 years of age and over is 5d. per hour with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

Merioneth and Montgomery.—An Order to come into operation on May 2, 1930 (*i.e.*, the day following that on which the existing rates are due to expire), and to continue in force until May 1, 1931. The minimum rate in the case of stockmen, teamsters, carters and shepherds of 21 years of age and over is 34s. (instead of 33s. as at present) per week of 60 hours, and in the case of other male workers of similar age 30s. per week of 54 hours with overtime in each case at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for all time worked.

Radnor and Brecon.—An Order continuing the operation of the existing minimum and overtime rates of wages from May 1, 1930, until April 30, 1931. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 54 hours in summer and 48 hours in winter, with overtime at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6¼d. per hour on weekdays and 7½d. per hour on Sundays.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

Enforcement of Minimum Rates of Wages.—During the month ending April 14, legal proceedings were instituted against 29 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines			Costs			Arrears of wages			No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	d.	
Cornwall ..	Camborne .	4	0	0	0	5	0	6	11	8	2
Derby ..	Swadlingcote	4	0	0	—			4	14	1	2
Devon ..	Honiton ..	1	0	0	—			37	16	7	1
Huntingdon	Ramsey ..	0	10	0	0	6	0	4	0	0	3
Kent ..	Maidstone	0	10	0	—			7	2	11	2
Monmouth	Abergavenny	1	0	0	2	2	0	6	3	1	1
,,	,,	1	0	0	2	2	0	17	0	0	2
,,	,,	0	2	0	0	8	0	5	9	10	2
,,	,,	1	0	0	2	2	0	30	0	0	1
,,	,,	1	0	0	2	2	0	10	0	0	1
,,	,,	1	0	0	2	2	0	22	0	7	1
,,	Raglan ..		†		0	12	6	11	9	8	1
,,	,, ..		†		0	12	6	4	10	2	1
,,	,, ..		†		0	12	6	20	0	0	1
,,	,, ..		†		0	15	6	14	10	6	1
,,	Cross Ash ..		—		—			50	0	0	2
,,	,, ..		—		—			33	0	0	1
,,	,, ..		—		—			7	0	0	1
,,	,, ..		—		—			27	10	0	1
,,	,, ..		—		—			10	0	0	1
Oxford ..	Burford ..		—		2	8	0	7	5	6	2
Salop ..	Oswestry ..		*		1	9	6	20	0	0	2
Somerset ..	Bridgwater	4	0	0	—			15	0	0	1
Yorks, E.R.	Hull ..	2	2	0	1	13	4	3	9	3	1
,, N.R.	Bedale ..	Case dismissed									1
,, W.R.	Doncaster	2	0	0	—			41	6	9	1
Carmarthen	Llandilo ..		*		2	11	0	14	0	0	1
,,	Llandyssul	0	1	0	—			3	15	8	1
Glamorgan	Whitchurch	1	0	0	—			2	10	0	1
		£24	5	0	£22	3	10	£436	6	3	39

* Dismissed under Probation of Offenders Act.

† Conviction recorded.

At Raglan a farmer and his labourer were prosecuted under Section 9 (3) of the Agricultural Wages (Regulation) Act for alleged refusal to furnish an Inspector with information as to the conditions of the worker's employment. Both pleaded "Not guilty." After hearing the evidence, in the course of which the defendants denied refusing information, the Bench convicted the worker and fined him ten shillings, but found that the Ministry had not proved its case against the farmer and dismissed the summons.

NOTICES OF BOOKS

The Gardener's Year Book, 1930. Edited by D. H. Moutray Read, F.R.H.S. Pp. 328. (London: Philip Allan & Co., Ltd. Price 3s. 6d. net.)

A tree, says the editor in her notes to the *Gardener's Year Book*, needs training and pruning as it grows; so with a Year Book. The arrangement of the contents has once more been altered in response to requests from various sources, matters of permanent interest being collected in tabular form at the beginning. Part I is completed by miscellaneous and cultural articles, the chronological and reference matter, directories, etc., being embodied in Part II. It is hoped that this arrangement will be found sufficiently satisfactory to render it permanent.

An interesting feature is the inclusion of reports from experiment stations summarizing the investigations in progress, and this cannot fail to be helpful to many gardeners and to arouse the wider interest in the work which the editor feels to be so desirable. An allied article is that describing "Openings for Women in Horticultural Research." Besides a number of articles of practical importance there are others on kindred questions such as "The Preservation of the Countryside" and "Safeguarding our Heritage of Beauty," while that dealing with "The Folklore of Trees" contains some details of amusing tree superstitions.

Essex County Farmers' Year Book, 1930. Edited and compiled by John B. Gill. Pp. 328. Illus. (Published at the Office of the Union, Corn Exchange, Chelmsford. Price 2s. 6d.)

In the current issue of this Year Book, the excellent character of which must be well known to a much wider circle of readers than the members of the County Farmers' Union, there are articles of a more varied character than usual, and these should prove of equivalent interest. Since there are 26 items in the contents list, it is obviously impossible, however, to do more than indicate the character of some of the contributions. The activities of the Union and its members, and of other organizations which play their part in the social life of the rural community, are adequately described. There are also articles of practical value to the farmer, such as the "Money Side of Bunted Wheat," by W. A. R. Dillon Weston and F. L. Engledow; "Waste on the Farm," by Col. F. H. D. C. Whitmore; and "Lucerne: Stray Thoughts on its Cultivation and Use," by Dennis Brown, to quote only a few. An article of interest to antiquaries in the county, and to those whose tastes lead them to inquire into the origins of our present system of land tenure and farming, is that by F. Dent and J. C. Urquahart entitled "Enclosures in Essex" (with map). Some of the other contributors, who are already well known to readers, both of the Year Book and of this Journal, are F. C. Hawkes, who writes on "Cereal Crops in Essex, 1927-1928"; R. G. Stapledon, on "Pasture Values"; R. H. Biffen, on "Intensive Wheat Cultivation," and H. V. Garner, on "Farmyard Manure." In addition to these, other specialists have devoted themselves to one or other aspect of their subjects, and on the whole it is not too much to say that here is a very full half-crown's worth of printed matter that is both interesting and instructive.

Journal of the Bath and West and Southern Counties Society. Edited by F. H. Storr. Pp. 188, cexi. Sixth series, Vol. IV, 1929-1930. (London: Edward Stanford, Ltd., 1930. Price to non-members, 6s. 6d.)

Besides reports upon the various departments of the show at Swindon, and on the Society's general operations, this volume contains a comprehensive report on the work of the National Fruit and Cider Institute, including a number of articles on particular subjects by specialist officers of that Institute. There are, in addition, six general essays on subjects of interest, both in the province covered by the Society's activities, and to the wider farming community of the whole country.

The first of these, "Intensive Grassland Management," by Viscount Folkestone, deals with an innovation in the business of the grazier which has occupied everyone's attention for the past few years, and this record of a series of trials of the system is a valuable contribution to the subject. Colonel F. S. Kennedy's "Survey of the Pig Industry in Sweden, Denmark and Holland" is also topical, and supplies information which must be of value to those who are interested in the reorganization of our pig breeding. "Tobacco Growing in England" is by A. J. Brandon, who has managed to make a success of the cultivation of this crop, and whose experience is now placed at the disposal of anyone who may care to attempt to emulate him. "British Forestry Policy," by the Rt. Hon. The Lord Clinton, Dr. J. A. Hanley's "The Royal Agricultural College, Cirencester," and G. E. Fussell's "The Evolution of Field Drainage" complete the list, and contain indications in their titles of the nature of their interest. The reputation of this Journal is already well established, and nothing that is said here could add very materially to it. This volume, however, maintains the standard of its predecessors.

The National Farmers' Union Year Book, 1930. (Published by the Union at 45 Bedford Square, London, W.C. 1. Price 5s. net.)

The current number of this Year Book contains the usual features which have come to be associated with it, and which make it an almost indispensable handbook for the farmer. The sections dealing with agricultural education and research, income tax and legislation affecting agriculture, are well known for their comprehensive character, and the farmer's statistical abstract contains a wealth of valuable information that should be of service in determining lines of development.

Sir John Russell deals with agricultural science and arable farming in 1929, and shows that the increased use of the new and improved synthetic fertilizers must inevitably bring about a large increase in the world's food supply. This condition will not help the British farmer who is already confronted with some difficulty in finding an economic market for his products. Sir John suggests that some part of the cure for these conditions, which are so certain to become accentuated, lies in the improvement of marketing methods so as to exploit to the full the value of having the British market close to the farm. Chapters nine and ten show what is being done along these lines to assist the producer to benefit himself, Mr. E. W. Langford dealing with "Collective Bargaining in the Milk Industry" and Mr. A. W. Street with the "National Mark."

The chapter dealing with the "Record of the National Farmers' Union" is an interesting review of the origin and development of the Union which attained its "twenty-first birthday" in December, 1929. Amongst other items of interest in this chapter is the statement

that the Year Book, originated in 1921, has now a circulation of over 100,000 copies, a significant indication that its value is properly appreciated.

The Farm Export Debenture Plan. By Joseph S. Davis, Director, Food Research Institute, Stanford University, California. Pp. x + 274. (Miscellaneous Publications of the Institute, No. 5, price $3.)

This book is a description, analysis and finally a condemnation of the plans for legislation designed to assist the financial position of the American farmer. Public dislike of any system of direct subvention to an industry in the United States seems more or less to preclude the possibility of subsidizing farming in that country. Consequently the farm export debenture plan has been devised to enable the Senate to pay a subsidy without paying one. Whether the plan will ever become law or not remains to be seen.

Briefly the idea is to issue debentures of so much per cent. of the value on specified agricultural products which are exported and to allow these debentures to be used by importers to pay their customs duties. Apart from the small banking charges and transfer brokerage necessarily involved in such a system, it is thought that practically the whole amount of the debentures will be reflected back to farm prices, but there is a considerable diversity of opinion in the United States as to the final effect of the plan if it should be adopted.

Mr. Davis is opposed to the plan, and he instances a number of objections. He also cites the export bounty system in use in this country during the major portion of the eighteenth century, but admits that the circumstances of the case were different, that the effect of the bounty on corn-growing and the general well-being of the farmer have not yet been accurately estimated, and that the system is not generally comparable with that now proposed to be brought to the aid of the farming community of the United States.

In its exposition of the trend of ideas for palliating the agricultural situation in the United States, the book has a connecting link of interest for agriculturists in this country, where conditions are equally difficult. But since, as regards agricultural produce, Britain is almost wholly an importing and not an exporting country, our very different circumstances must confine our interest to the academic aspect of the scheme which the book describes.

Modern Fruit Growing. By W. P. Seabrook. Third Edition. Pp. xiii + 278. Illus. (London: Ernest Benn, Ltd. 1929. Price 6s. net.)

After 20 years' practical experience in fruit growing, Mr. Seabrook gives in this little book his views of the business side of fruit growing. Everything is discussed from that angle, and he has touched upon nearly every matter that concerns the practical grower.

In the author's views light soils with porous subsoils are more profitable for fruit growing than heavy soils, and he is evidently not in favour of heavy manuring. Brown mustard for green manuring is mentioned so often that it is probably much used on the author's farms. With some hesitation, artificials are advised, especially sulphate of potash.

The surprise chapter deals with stocks, and where we had expected to read of the usual orthodox statements concerning seedling and paradise stocks, we find views that are somewhat ahead, even of research work. The author's view is that the Doucin or Malling Type II is the best of all possible stock for apples because it induces fruiting in the early years, though eventually it produces a vigorous growing and permanent tree. The Jaune de Metz or Malling Type IX is said

to be the only stock that exercises a permanent dwarfing effect. Suitable market varieties are mentioned, and beginners should benefit from the notes made on each one.

Methods of cultivation, pruning and marketing are all discussed from the practical standpoint. There is also a chapter headed "Finance and Records," in which the writer starts by lashing out at farmers generally for not keeping books, and then gives actual costs for each operation—tractors, planting, hoeing, steam subsoil ploughing, etc.—and includes a table of the total cost of planting up orchards, as made on his own farms in Essex. Gross money returns for selected orchards follow. It is seldom that detailed figures like these are given, and they should prove useful for reference purposes to those about to plant.

It appears that an outlay of £30 to £50 per acre has been incurred (apart from the cost of the land) in planting orchards during the first two years. The returns commenced to come in the third year and then increased annually. The expenditure and revenue figures show a good profit and support the writer's claim that no section of agriculture offers greater chances of success than fruit growing.

The book should be of great value to those who propose to take up fruit growing on modern lines, but as the subject matter of the book centres round methods performed on certain soils in Essex, modifications may be necessary in the case of other soils and districts.

Industrial Arbitration in Great Britain. By Lord Amulree, G.B.E. Pp. 233. (London: Humphrey Milford, Oxford University Press. 1929. Price 12s. 6d. net.)

The interest of this book for the agriculturist lies in the relation between the development of industrial arbitration in general and the formation of the Agricultural Wages Board, which was set up, not under the Trade Boards Act of 1908 and 1918, but under the provisions of the Corn Production Act, 1917. Unfortunately, the amount of space given to the Wages Board in the book is very small, as indeed might be expected in a general treatise of this nature, because the Board is a minor incident in the story.

The book is a record of attempts to embody in terms of legislation forms of administration for which there was a fluctuating and, even in the best moments, not universal demand from all the parties who would be affected by it. The attempts that were made seem to have been characterized by what we should now term timidity of outlook, comprehendible enough, however, in a period dominated by a policy of *laissez faire*. There was also inability to envisage the necessities of the case in such a way as to make the laws passed enforcible; such Acts as were passed soon became dead letters, even if they were ever operative, and it was only after voluntary organizations had provided experience of what would be a practical policy that the State was able to legislate with some prospect of effect. There was also a prejudice on the part of both employers' and workmen's organizations against compulsory arbitration, and this seems not to have been entirely overcome until the War Committee on Production was appointed and had made its influence felt. The work of this Committee gave evidence of the value of periodic meetings between employers and employed, after the manner of the Board set up for the hosiery trade in Nottingham in 1860 under Mr. Mundella. The machinery has now become so familiar a phase of industrial life that it is a little difficult to realize that we have not long passed the time when no such organization existed to enable us to avoid the dangers of industrial strife, wherever that is humanly possible. The greatest factor in this, like that in international peace, is, however, as Lord Amulree so pertinently says, "the will to peace possessed by the parties concerned."

Index Londonensis. Vol. I (A to Campanopsis. Pp. xx + 547), 1929, and Vol. II (Campanula to Dysphania. Pp. 548), 1930. (Oxford: The Clarendon Press. Price £5 5s. 0d. net each volume.)

For this revision of Pritzel we are indebted to the labours of Sir David Prain, some time Director of the Royal Botanic Gardens at Kew, and the Royal Horticultural Society. The work, for the original edition of which Pritzel was responsible, is an index of illustrations of flowers which may be found in the different works on botany and botanical subjects. Obviously this is of the greatest service to the botanist who wishes, without undertaking a laborious and possibly profitless search of the literature, to identify a flower with which he may be unacquainted, and equally obviously the original edition, published some 70 years ago, has for many years required revision.

The first two volumes of the revision have now been issued and four further volumes will follow; it is hoped to keep the revision up to date by the issue of supplements at intervals of 15 years so as to avoid the necessity for a re-issue of the work as a whole in the future. The Royal Horticultural Society is to be complimented upon the format of the book and upon having undertaken a work of such importance.

SELECTED CONTENTS OF PERIODICALS

Agriculture, General and Miscellaneous

Scottish Agriculture: Its Present Position and Future Prospects. (Short articles by a number of prominent representatives of Scottish Agricultural interests.) (Scottish Jour. Agric., XIII, 1 (Jan., 1930), pp. 1-29.) [338.1 (41); 63 (41).]

A New Method of the Comparing the Productivity of Crops on Arable Land in England and Wales, Scotland, and Denmark. *H. Faber.* (Jour. Roy. Stats. Soc., XCII, 4, 1929, pp. 559-579.) [31 (42); 31 (489); 63 (42); 63 (489).]

The Stabilisation of Wheat Prices. *E. F. Wise.* (Jour. Farmers' Club, 1930, Part 1 (February), pp. 3-28.) [338.5, 338.9; 63.311 : 31.]

The Activities of the Federal Farm Board in the United States (Memorandum compiled by the Standard Statistics Co. of New York.) (Econ. Jour., XL. 157 (March, 1930), pp. 69-78.) [334 (73); 334.6; 338·1 (73).]

Agricultural Index Numbers and Farm Accountancy. (Int. Rev. Agric. (Part II, Mon. Bull. Agric. Econ. and Soc.), XX, 12 (Dec., 1929), pp. 481-485.) [338.1; 338.5.]

A Note on the Value of Uniformity Trials for Subsequent Experiments. *H. G. Sanders.* (Jour. Agric. Sci., XX, 1 (Jan., 1930), pp. 63-73.) [37 (01).]

Soils and Fertilizers

Studies in the Physical Properties of Soil. V: The Hysteresis Effect in Capillary Properties, and the Modes of Moisture Distribution associated therewith. *W. B. Haines.* (Jour. Agric. Sci., XX, 1 (Jan., 1930), pp. 97-116.) [63.112.]

The Value of Raw Sewage Sludge as Fertilizer. *J. F. Muller.* (Soil Sci., XXVIII, 6 (Dec., 1929), pp. 423-432.) [63.164.]

The Application of Mole Draining to Scottish Soils. *M. M. Monie.* (Scottish Jour. Agric., XIII, 1 (Jan., 1930), pp. 51-56.) [63.14.]

Crops and Cultivation

Silage Mixtures (Notes from Agricultural Colleges—Kilmarnock.) (Scottish Jour. Agric., XIII, 1 (Jan., 1930), pp. 75-77.) [63.33.]

Surplus Potatoes. I. The Use of Potatoes and Oats as Feeding-stuff. (From the Duthie Experiment Stock Farm, Rowett Institute); II. Industrial Uses, General Policy and Marketing. *T. P. M'Intosh.* (Scottish Jour. Agric., XIII, 1 (Jan., 1930), pp. 30-43.) [63.344; 63.349; 63.512; 63.512:38; 63.60432.]

Hop-Drying Investigations: their Aims, and Results Already Attained. *A. H. Burgess.* (Jour. Inst. Brewing, XXXVI, 2 (Feb., 1930), pp. 57-63.) [63.19831; 63.3451.]

Physiological Studies in Plant Nutrition. II.—The Effect of Manurial Deficiency upon the Mechanical Strength of Barley Straw. *F. R. Tubbs.* (Ann. Bot. XLIV, 173 (Jan., 1930), pp. 147-160.) [58.11; 63.161; 63.313.]

Studies of the Physiological Importance of the Mineral Elements in Plants. I—The Relation of Potassium to the Properties and Functions of the Leaf. *W. O. James.* (Ann. Bot., XLIV, 173 (Jan, 1930), pp. 173-198.) [58.11; 63.113; 63.1673.]

Some Effects of Seed Treatment on the Germination and Subsequent Growth of Wheat. *D. C. Smith* and *E. N. Bressman.* (Jour. Agric. Res., 40, 1 (Jan. 1, 1930), pp. 25-36.) [63.1952; 63.311.]

Utilisation of Paper as a Mulch. (Int. Rev. Agric. (Part I., Mon. Bull. Agric. Sci. and Pract.) XX, 11 (Nov., 1929), pp. 429-432.) [63.191.]

Pasture

Intensive Rotational Grazing of Pastures. Various Aspects of the System in New Zealand. *A. W. Hudson.* (New Zealand Jour. Agric., XXXIX, 6 (Dec. 20, 1929), pp. 400-408.) [63.33; 63.33-16.]

Improvement of Rough Grazing Land. (Scottish Jour. Agric., XIII, 1 (Jan., 1930), pp. 73-75.) [63.33-16.]

A Botanical Study of Hay Plots. *E. Wyllie Fenton.* (Ann. App. Biol., XVII, 1 (Feb., 1930), pp. 107-126.) [63.33.]

The Protein Content of Grass, chiefly Meadow Foxtail (*Alopecurus pratensis*) as Influenced by Frequency of Cutting. *F. T. Shutt, S. N. Hamilton* and *H. H. Selwyn.* (Jour. Agric. Sci., XX, 1 (Jan., 1930), pp. 126-134.) [63.33; 63.60433.]

Nutritive Value of Pasture. V.—Pasture Grass Conservation: The Influence of Artificial Drying on the Digestibility of Pasture Herbage. *H. E. Woodman, J. W. Bee* and *G. Griffith.* (Jour. Agric. Sci., XX, 1 (Jan., 1930), pp. 53-62.) [63.1983; 63.19831; 63.33; 63.60433.]

Horticulture

The Rooting of Woody Cuttings considered from the Standpoint of Anatomy. *W. A. Sledge.* (Jour. Pom. and Hort. Sci., VIII, 1 (Jan., 1930), pp. 1-22.) [58.11; 63.41-195.]

Experiments on the Manuring of Fruit Trees. III—The Effects of Deficiencies of Potassium, Calcium, and Magnesium, respectively, on the Contents of these Elements, and of Phosphorus in the Shoot and Trunk Regions of Apple Trees. *T. Wallace.* (Jour. Pom. and Hort. Sci., VIII, 1 (Jan., 1930), pp. 23-43.) [63.41-16.]

Experiments on the Effects of Leaching with Cold Water on the Foliage of Fruit Trees. I—The Course of Leaching of Dry Matter, Ash and Potash from Leaves of Apple, Pear, Plum, Black Currant and Gooseberry. *T. Wallace.* (Jour. Pom. and Hort. Sci., VIII, 1 (Jan., 1930), pp. 44-60.) [63.41.]

The Time of Differentiation of the Flower-bud of the Apple. *Margaret A. Gibbs* and *T. Swarbrick.* (Jour. Pom. and Hort. Sci., VIII, 1 (Jan., 1930), pp. 61-66.) [58.11; 63.41.]

Studies in the Root and Shoot Growth of the Strawberry. V—The Origin, Development, and Function of the Roots of the Cultivated Strawberry (Fragaria Virginiana X Chiloensis). *C. E. T. Mann.* (Ann. Bot., XLIV, 173 (Jan., 1930), pp. 55-86, pl. VIII–X.) [58.11; 63.41.]

The Gas Storage of Fruit. II—Optimum Temperatures and Atmospheres. *Franklin Kidd* and *C. West.* (Jour. Pom. and Hort. Sci., VIII, 1 (Jan., 1930), pp. 67-77.) [664.85.]

Experiments on the Storage of Pears in Artificial Atmospheres. *S. A. Trout.* (Jour. Pom. and Hort. Sci., VIII, 1 (Jan., 1930), pp. 78-91.) [664.85.]

Refrigeration of Flowers, Fruit and Vegetables. *F. E. Garnett.* (Jour. Roy. Hort. Soc., LV, 1 (Jan., 1930), pp. 64-71.) [63.41-198; 63.51-198; 63.522; 664.8.]

Contributions from the Wisley Laboratory. LV—Some Experiments with Ultra-Violet Ray Glasses. *M. A. H. Tincker.* (Jour. Roy. Hort. Soc., LV, 1 (Jan., 1930), pp. 79-87.) [58.11; 63.5-19.]

Carbon Dioxide in Relation to Glasshouse Crops. Part IV—The Effect on Tomatoes of an Enriched Atmosphere maintained by means of a Stove. *T. Small* and *H. L. White.* (Ann. App. Biol., XVII, 1 (Feb., 1930), pp. 81-89.) [63.5-19; 63.513.]

Plant Pests and Diseases

Field Experiments on the Deterioration of Scotch Potato Seed in England. *W. Brown* and *V. H. Blackman.* (Ann. App. Biol., XVII, 1 (Feb., 1930), pp. 1-27.) [63.23; 63.512.]

Bacterial "Blight" of Walnuts in Britain. *H. Wormald.* (Ann. App. Biol., XVII, 1 (Feb., 1930), pp. 59-70, pl. IV.) [63.23.]

The Relation of Atmospheric Temperature and Humidity to Tomato Leaf Mould (*Cladosporium fulvum*). *T. Small.* (Ann. App. Biol., XVII, 1 (Feb., 1930), pp. 71-80.) [63.24.]

Sulphur as a Soil Fungicide against the Potato Wart Organism. *W. A. Roach* with an Appendix by *R. P. Hobson.* (Jour. Agric. Sci., XX, 1 (Jan., 1930), pp. 74-96.) [63.24; 63.295.]

The Oak and Apple Mildews Compared. (Jour. Pom. and Hort. Sci., VIII, 1 (Jan., 1930), pp. 91-92.) [63.24.]

Gibberella Saubinetii (Mont.) Sacc. on British Cereals. *F. T. Bennett.* (Ann. App. Biol., XVII, 1 (Feb., 1930.), pp. 43-58.) [63.24.]

The Effect of a Seed Disinfectant on Grain and Straw Yields and Smut Control in Winter Barley. *J. W. Taylor* and *M. G. Zehner.* (Jour. Amer. Soc. Agron., XXII, 2 (Feb., 1930), pp. 113-123.) [63.24; 63.294; 63.313.]

On the Curly Top Disease of the Sugar Beet. A Biochemical and Histological Study. Summary of Results. *E. P. Mumford.* (Ann. App. Biol., XVII, 1 (Feb., 1930), pp. 28-35, pl. I and II.) [63.27.]

Aphis as a Possible Vector of "Breaking" in Tulip Species. *A. W. McKenny Hughes.* (Ann. App. Biol., XVII, 1 (Feb., 1930), pp. 36-42, pl. III.) [63.27; 63.23; 63.522.]

The Biology of Thysanoptera, with reference to the Cotton Plant. V—The Relation between the Degree of Infestation and the Type of Soil. *Elsie I. MacGill.* (Ann. App. Biol. XVII, 1 (Feb., 1930), pp. 150-161.) [63.27.]

The Fungicidal Properties of Certain Spray-Fuids, VI. *W. Goodwin, H. Martin* and *E. S. Salmon.* (Jour. Agric. Sci., XX, 1 (Jan., 1930), pp. 18-31.) [63.24; 63.295.]

Polysulphide Sulphur in Relation to the Fungicidal Efficiency of

Certain Spray Materials. *W. Goodwin, H. Martin* and *E. S. Salmon.* (Ann. App. Biol., XVII, 1 (Feb., 1930), pp. 127-136.) [63.295.]

The Hydrolysis of Sulphur in Relation to its Fungicidal Activity. *H. Martin.* (Jour. Agric. Sci., XX, 1 (Jan., 1930), pp. 32-44.) [63.295.]

Live Stock and Feeding

Recent Developments in the Breeding and Management of Sheep in Great Britain. *R. G. White.* (Jour. Farmers' Club, 1929, Part 6 (December), pp. 97-115.) [63.603 ; 63.631.]

A Study of Nitrogen Metabolism in Sheep on High Protein Diets. *J. Stewart.* (Jour. Agric. Sci., XX, 1 (Jan., 1930), pp. 1-17.) [612.394 ; 63.631 : 043.]

A Cheviot Flock on Exmoor Forest. *D. Skilbeck.* (Scottish Jour. Agric., XIII, 1 (Jan., 1930), pp. 64-69.) [63.631.]

Sugar Beet Tops as a Food for Fattening Bullocks, and their Manurial Value when Ploughed in. *S. T. Johnson* and *H. Fail.* (Roy. Agric. Soc. of England, Occasional Notes, Dec., 1929, pp. 1-11.) [63.165 ; 63.60432 ; 63.60433 ; 63.62 : 043.]

The Influence of a Low and High Calcium Diet on the Development and Chemical Composition of the Skeleton in Swine. *R. E. Evans.* (Jour. Agric. Sci., XX, 1 (Jan., 1930), pp. 117-125). [612.394; 63.64 : 043.]

Dairying

Feeding Standards for Dairy Cows. *E. T. Halnan.* (Jour. Dairy Res., I, 1 (Nov., 1929), pp. 3-34.) [63.711 ; 63.711 : 043.]

The Science of Dairy Cattle Feeding: Present Position. (Int. Rev. Agric. (Part I, Mon. Bull. Agric. Sci. and Pract.) XX, 11 (Nov., 1929), pp. 451-458.) [63.711 : 043.]

Factors Affecting the Yield and Quality of Milk. II—Variations in Successive Lactations. *J. Glen* and *A. C. M'Candlish.* (Jour. Agric. Sci., XX, 1 (Jan., 1930), pp. 45-52.) [612.664 ; 63.711.]

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NOTES FOR THE MONTH

County Agricultural Education

THE Minister formally opened the new Farm Institute of the Kent Agricultural Education Committee at Borden, near Sittingbourne, on May 15. In his address, Mr. Buxton said that one of the most noticeable features of agricultural history in this country since the War had been the great development of county work on agricultural education. After the War the provision of funds on a relatively generous scale by the Treasury, supplemented later by the £850,000 set aside by Parliament for agricultural development when the Corn Production Acts were repealed in 1921, gave an impetus to expansion which had been felt in every department of education and research. Gratifying as this development was, however, there were still defects in the system, viewed as a whole, which needed remedying. In particular, the expansion had not by any means been uniform all over the country. Some counties had adopted a most progressive policy ; others, with agricultural interests of equal importance, had so far taken very little action. The response, however, to the Government's offer to assist County Councils to extend their educational activities had been most encouraging, and he was glad to know that Kent—already one of the most progressive authorities in this sphere—was taking the opportunity to develop still further the county work. Now that the new Borden Farm Institute was established, Kent was a singularly favoured county in the way of education and research. It had within its boundaries one of the best of research institutes, the East Malling Station, which had done work for fruit growers which is well known and appreciated, not only in Kent and in England but all over the world. It had one of the best of Agricultural Colleges, the South-Eastern Agricultural College, Wye. It had a Women's College, Swanley, which was doing valuable work ; and now it had a Farm Institute, for which in a different sphere a career might be anticipated no less useful than for the other three institutions named.

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Referring in particular to the work of Farm Institutes, Mr. Buxton said that 11 new institutes had been established and equipped by County Councils since the War, making a total of 17 now at work. In addition, there were at least five new institutes contemplated. The farm institute was an essential part of the national scheme of agricultural education; it might, in fact, be said to be the foundation of the system. It was supplying technical instruction for the new generation of farmers, and, although the system was of such recent growth, the beneficial results were already becoming apparent all over the country. The great majority of students were the sons and daughters of farmers, who took the knowledge they had gained back into the industry at the end of their courses. For example, 650 of those who had held the Ministry's scholarships (for the most part tenable at farm institutes) had returned to agricultural work. The noticeable increase in the interest taken by farmers in scientific work could be attributed in no small measure to this influx of farm institute students into the industry.

In conclusion, Mr. Buxton pointed out that it had been estimated in 1925 that the annual value of the agricultural output in England and Wales was about £225 million. Could it possibly be maintained in the face of these figures that an annual expenditure of £750,000 a year on agricultural education and research was excessive?

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Calendar Reform

THE Gregorian calendar, now used by every important nation in the world, is comparatively modern, being less than 350 years old, and having been used in England and America for only 200 years. It is, indeed, only since the War that important units of the world's population have adopted it, either wholly or in part. These are Russia, the Greek Orthodox Churches, and the Mohammedan nations. In spite of its universality, however, there are, for various reasons, disadvantages in our way of reckoning time. This is particularly so in the case of agricultural meteorology, and has been commented on by Sir Napier Shaw, both at a Conference in 1927 in connexion with the agricultural meteorological scheme of the Ministry of Agriculture, and at the Conference of Empire Meteorologists, 1929 (Agricultural Section).

In addition to this, there are other reasons for the reform of the calendar, and the whole question has been under the consideration of the League of Nations, and that body has

requested all nations to form national committees to report upon the feelings of their peoples for or against calendar improvement, since there is even to-day a sentiment that it would be sacrilegious to alter or change it. This arises out of ancient history, but as the calendar has been modified frequently in historical times the feeling is really quite baseless.

The first measures of time were the day, the lunar month, and the return of the seasons of seed time and harvest, but the last two are irregular and uncertain, and the first do not help much in learning the time to plant and sow. The idea of the sacred nature of the calendar is derived from the fact that in Egypt, where the priests and astronomers first learned the number of days and fractions in a solar year, and by watching and measuring the shadows cast by the great pyramids were able to fix the exact dates of the equinoxes, this knowledge was jealously guarded and kept secret from all other nations. The priests and rulers of Egypt were thus able to instruct the people, mainly agriculturists, in the best times to plant and gather their crops. This knowledge enabled the Egyptians to provide so well for themselves that it was said that there was always corn in Egypt. Moses improved upon the Egyptian calendar and formed a perpetual solar calendar which was used until the time of the Babylonian captivity, when it fell into confusion and the Jews adopted the lunar calendar of their masters. Many changes have been introduced, nearly always for practical reasons, but having occasionally some religious purpose or the idea of the aggrandisement of some great king. To Julius Cæsar must be attributed the return to a solar calendar, modifications of which have given us our modern system of time reckoning. It is now proposed to simplify our calendar by restoring the ancient and lost Mosaic plan.

The inequality of the lengths of our months makes a comparison of the meteorological data, collected in those periods, and applicable to agriculture and phenology, difficult. Moreover, the month is a long time to carry over a memory of the weather, and the variation within that time may be of more practical importance than the mean value. The week is a much more convenient period, and the influence on vegetation of the weather during that time could not be missed by anyone making a weekly visit of inspection, when the salient features of the week's weather would still be in mind, whereas the conditions at the beginning of a month may be only dimly remembered at the end of it. Again, a weekly record is of more value than a daily one, because there would be more change to record, and the contrasts would thus be more striking.

Apart from its inconvenient length, the calendar month, so-called, is a very unscientific unit, being of an arbitrary and unequal length. Originally the months were intended to mark certain stages in the solar declination, but they fail to do it. The changes it is proposed to make have the purpose of making the divisions of the calendar fulfil this intention, and there does not seem to be any insuperable difficulty to be overcome. The title of Sir Napier Shaw's paper, given at the Conference of Empire Meteorologists, 1929 (Agricultural Section), was: "Ten Points of a Weekly Calendar," and this paper sets out the advantages of the proposed new system and suggests methods which might be adopted to render it practicable.

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Dairying Fortnight at the Antwerp Exhibition

PARTICULARS of the agricultural congress arrangements at the International Exhibitions at Antwerp and Liege this year were given in last month's (May) issue of this JOURNAL (p. 112). An additional fixture at the Antwerp Exhibition will be the holding of an International Dairy Show from July 5 to 21. This has been organized, under the auspices of the Belgian Government, by the International Dairy Federation in collaboration with the Belgian Dairymen's Associations, and will be held in the Exhibition grounds. The Show will include sections for dairy implements and apparatus (both for the farm and for factory use), and there will be exhibitions of butter, cheese, and milk products. In connexion with the butter and cheese sections, there will be competitions for national and international produce. Further particulars concerning the dairying fortnight can be obtained from the Permanent Secretariat of the Exhibition, Minderbroedersrui, 17, Antwerp.

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Seed Testing Course and Examination

A COURSE of instruction in the principles and practice of seed testing will be held at the Official Seed Testing Station for England and Wales, Huntingdon Road, Cambridge, beginning on June 24 and ending on July 22, 1930. The course will be followed by an examination on July 23 and 24. Particulars, syllabus and application forms can be obtained from the Secretary, National Institute of Agricultural Botany, Huntingdon Road, Cambridge.

Live Stock in Relation to Tillage

ON May 21, Sir William S. Haldane broadcast an address on this subject, in which he pointed out that the prosperity of farming in this country depended, for marketable produce, to a much greater degree upon stock than upon crops. The revised Census of our farm production shows that in 1927-28 the value of the produce sold off farms in Great Britain as live stock or its products was £183,700,000, compared with only £57,800,000 for all the farm crops put together. The decrease of tillage leads Sir William to believe that live stock returns are now probably at least four times those from farm crops. Again, live stock must be regarded as mechanism for converting crops into marketable form and money, because it is increasingly difficult to sell the crops direct at a profit. The kind of crops grown on almost any farm will therefore depend mainly on what live stock will consume them.

Sir William is of opinion that because corn is carried cheapest of all forms of foodstuffs, and this country is accessible by cheap sea transport, it is immutably established that our breadstuffs shall mainly be supplied from abroad, and the practice of feeding home-grown cereals on the farm is the best and most profitable way of disposing of them. He dealt mainly with cattle and beef production, and did not neglect to consider the competition of chilled beef from overseas, but he feels that this competition can be met by the production of beef of high quality. The home market demands quality in almost every product, and is prepared to pay for it, and, apart from initial cost, production and finish of well-bred cattle and sheep is relatively cheaper than in the case of lower quality animals. There are still far too many scrub bulls used, although there are plenty of good type bulls to be had at moderate cost. Sir William therefore considers that we should follow the example of Ireland in discarding the scrub bull, when we should be rewarded by higher prices such as that country is now obtaining for good quality store cattle.

He ended his talk on a hopeful note by saying that, to enable British agriculture once more to pay its way, the production of cattle of good beef type is a prime necessity, as the efficient machinery for converting our main crops into the product of best value. Of like necessity is the growing of these crops, so that meat production, summer and winter, may be spread evenly throughout the year in an economic manner. With sufficient winter feed we could avoid the

losses to graziers year after year through shortage in spring supplies of stores, and market gluts in autumn of unfinished cattle from the grass forced to be sold through want of winter keep. It is only by maintaining a close relationship between the numbers of our live stock and the extent of our tillage and winter food that the great majority of our farmers can make a satisfactory living.

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Bullock Feeding on Sugar Beet Tops and Pulp

A SERIES of trials in bullock feeding on sugar beet tops and pulp have been carried out on the farm of the Norfolk Agricultural Station. These trials have been made possible by a grant from the Research Committee of the Royal Agricultural Society of England, and a full report of the trials will be found in the 1930 volume of the Society's Journal. The trials have been carried out during the past three years, and have been made in each year with groups of ten to twelve bullocks on a common basal ration, consisting of hay, straw and concentrates, to which an allowance of dried pulp, tops or roots has been added as the case may be. Periodical weighings were made to check the progress of the animals, which were sold by dead weight to a Norwich butcher, who examined every carcass, and gave his opinion on each. The 1929-30 animals had not been killed when the report had been written. The beasts were north-country Shorthorns purchased each year for the trials, and were about twenty months old when put in the yards early in October; they were weighed and selected so as to be as strictly comparable as possible.

It is impossible to give here a complete description of the trials, and details of the costs and results: those who wish for these details must consult the full report. The results are, however, summarized by Mr. S. T. Johnson, the writer of the report. He indicates that the winter of 1928 was characterized by unusual frost. Feeds which are liable to exposure to the weather were, therefore, at a disadvantage, and the compulsory cessation of top feeding at an early date (December 18) and of root feeding a few weeks later, must be counted as a point in favour of the dried pulp. At the same time the perishable nature of the tops, and the damage they suffered from severe weather and the manner of handling in the field, may have lowered their value below its average level.

In 1929, the use of ground chalk in the ration appeared to have prevented the recurrence of the scouring which was a

troublesome feature of the first week or two in the 1928 trial. The animals eating the tops in the 1929 season always looked well and their live weights confirmed their appearance of thriftiness. Lime, in one of the forms in which it is placed on the market for feeding purposes, should always be included in the diet of bullocks when sugar beet tops are being fed.

Sugar beet tops and dried sugar beet pulp have been found to be thoroughly satisfactory substitutes for swedes. The approximate equivalent quantities are indicated in the report. While the tops undoubtedly possess considerable manurial value when ploughed down, it is quite obviously wasteful to use them in this way, since their manurial equivalent can be purchased very much more cheaply than their food equivalent. The waste of food material when sugar beet tops are much trampled upon in the field may be considerable. It is recommended that they should be thrown into heaps or rows to avoid carting over them, as far as possible.

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Assistance for British Glasshouse Industry

THE Hertfordshire Institute of Agriculture has recently set up a new department to assist the glasshouse industry by practical and technical education. The glasshouses for tomatoes, cucumbers, and other crops supplied under this educational scheme were opened on Thursday, May 15. The plant will now be run as a demonstration profit-earning department. It will provide, also, the necessary practical and commercial instruction, so that skill in manual work may be developed and knowledge in tillage, manuring, and control of pests and diseases may be thoroughly mastered by students.

Courses for young men who propose to become growers of glasshouse produce are held at the Institute for minimum fees. The fees for non-residential students living in Hertfordshire are 10s. a week; other students 20s. a week; and for residential students from Hertfordshire £1 15s. 0d.

The Hertfordshire Institute of Agriculture, Oaklands, St. Albans, is the first of the County Farm Institutes which has been developed to give instruction in this class of horticultural work. It is not far removed from the centre of the very important industry in the Lea Valley, and should do a great deal to help the future of that and similar glasshouse areas. Notes on the glasshouse equipment at this Institute have already appeared in this JOURNAL (Dec., 1929, p. 802, and Feb., 1930, p. 1029).

Annual Returns of Crops and Live Stock under the Agricultural Returns Act, 1925

THE annual agricultural returns will be collected again this year on June 4. These returns are compulsory under the provisions of the Agricultural Returns Act, 1925, and every occupier of more than one acre of agricultural land, which includes orchard land, market gardens and nurseries, is required to make a return. The forms for the returns will be issued immediately before June 4, and when completed they should be forwarded to the Crop Reporter, whose address appears on the back of the form. It is hoped that all occupiers will make their returns promptly, so that there may be as little delay as possible in the publication of the tabulated results.

The Act provides that no individual return or part of a return may be used, published or disclosed except for the purposes of the preparation and publication of agricultural statistics, or of prosecutions under the Act.

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Italian Agricultural Experiment Stations

IN these days, when the development of agricultural science is so great and its scope is widening so rapidly, it is a little surprising to learn that a progressive country like post-war Italy has promulgated a decree prescribing that no new experiment stations shall be set up or subsidized by the Government for a period of ten years. The decree, which was made in October last, provides for the organization of the existing stations of two classes: those known as Royal Agricultural Experiment Stations and those of societies (consortia). The latter, however, are ordered to conform as far as possible with the organization of the former, both being under the control of the Ministry of Agriculture.

The measure makes provision for an expenditure of eight million lire, during the next two financial years, for organizing the government stations, and for annual grants, the amounts of which are to be determined later by decree of the Ministries of Agriculture and Finance.

This decree follows one passed in September last regarding the transformation of the Ministry of National Economy into a Ministry of Agriculture and Forests, which will comprise an extra Under Secretary of State dealing with co-ordinated land reclamation matters. It should be added that Italy possesses a number of Agricultural Experiment Stations which deal with most branches of science of interest to the agriculturist.

THE RESEARCH SCHOLARSHIP SCHEME

Sir DANIEL HALL, K.C.B., LL.D., F.R.S.,
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IN 1911, the Development Commission, in conjunction with the (then) Board of Agriculture, had instituted its scheme for the prosecution of agricultural research. The chief Research Institutes had been started, and although some additions and rearrangements have been made since the War, the nucleus of the organization was provided and the scheme in its essentials remains unchanged. The chief problem at the time was to provide men to staff the new Institutes. Hitherto, there had been few opportunities in this country for investigators in the sciences bearing upon agriculture. The only organized institution was the Rothamsted Experimental Station, which, after Gilbert's death, had obtained some private benefactions that had enabled it to add to its permanent staff and to enlist a few young workers who looked to investigation as a career. The School of Agriculture at Cambridge was also active under Wood and Biffen, and had turned out many good men who had to find their outlet in India and the Colonies.

But even when heads could be found for the new Institutes (and for one of them, indeed, a distinguished foreigner was sought) it was clear that they would have to train the members of their staff and could not find them ready made. Accordingly, the Development Commission instituted a system of scholarships which has been maintained down to the present day. The conditions stipulated that candidates were to be graduates with honours in some school of pure science—chemistry, botany, zoology—and they might offer to pursue any of the subjects in which the Institutes were engaged, *e.g.*, soils, the physiology or pathology of the plant, economic entomology, genetics of plants or animals, animal nutrition and so forth. Scholarships were also offered in animal pathology to graduates at one of the veterinary colleges.

This principle of demanding a preparatory training in pure science was a recognition of the fact that the investigation of the living organism—and nearly all research bearing on agriculture is concerned with plant or animal life—makes demands both as regards knowledge and technique which are beyond the purview of a man who has only learnt his science as one element in the course for a degree in agriculture. The day was past when an agricultural chemist needed only to

be able to determine nitrogen and the other elements in soils, plants and fertilizers; he needed to be familiar with the conceptions of physical chemistry or with the methods of organic synthesis and separations. Although in some quarters there still lingers the belief that an agricultural college course fits a man for any and every kind of scientific work (and has in its favour the career of one or two men of genius who have taken the kingdom of heaven by storm), the principle of demanding a preliminary training in pure science has been generally accepted and has since been adopted by other organizations giving post-graduate scholarships for agricultural science.

The scholarships were tenable for three years, and were to be held, in the first instance, at one of the Research Institutes, and for the final year or more at a foreign institution under the direction of some distinguished exponent of the scholar's particular subject. No guarantee of employment was given; at the same time no condition was attached to compel the scholar to accept service in the Institute for whose work he had been trained. It has often been suggested that scholars elected for a particular purpose should undertake to repay the allowances they have enjoyed if they take up some other line of life. However, it has rightly been held that such a condition is impracticable. It can rarely be enforced, especially when it is not accompanied by the other condition of a promise of employment, and an unwilling worker would be of less than no value in research. Moreover, even if the scholar, either immediately or at some period after his scholarship has terminated, does take service with, say, a great agricultural corporation, the purposes of the State in giving the scholarship have been fulfilled. A man capable of advancing the industry has been prepared and is being made use of by the industry.

This scheme of post-graduate scholarships has now been in operation for nearly twenty years, time enough to take stock of its results and to see to what extent it has satisfied the expectations upon which it was instituted. One must, however, take into account its interruption by the War. Three scholarships only were awarded in 1914, two of which had a duration of one year only, and it was not until 1919 that the awards were renewed. It may be convenient, then, to divide the scholars into two groups, 47 who were elected in the years 1911-14, and 49 who were elected in the years 1919-1925. Of the scholars elected in 1926 and later, little can be said: indeed, in many cases they have not completed their training.

1911-14.—Of the earlier group, fourteen now hold posts in one or other of the Research Institutes or as Advisers at one of the agricultural colleges, whereby they are equally officers in the research service. Among these are men who have already made their mark as leaders in their branch of work. Professor Engledow [1913], after being Assistant Director of the Plant Breeding Institute at Cambridge, has recently been appointed Drapers' Professor in the University of Cambridge, and thus is head of the most important school of agriculture in the country. John Hammond [1911] has done distinguished work in the physiology of reproduction, and is head of the physiology section of the Animal Nutrition Institute at Cambridge. A. W. Ashby [1912] is head of the Advisory Economic Service for Wales and Professor in the University College of Aberystwyth. F. C. Minett [1912] is Director of the Research Institute attached to the Royal Veterinary College. E. T. Halnan [1911] is head of the Poultry Nutrition Section of the Animal Nutrition Institute at Cambridge.

Nine of the scholars are in the agricultural services in India or the Dominions. These include A. E. Cameron [1912], Professor of Biology in the University of Saskatchewan; James Davidson [1912], Entomologist in the Waite Agricultural Research Institute, South Australia; Paul Murphy [1912], Professor of Plant Pathology in the National University of Ireland; J. A. Prescott [1912], Professor of Agricultural Chemistry at the Waite Institute; F. J. Meggitt [1913], Professor of Biology in the Rangoon University, etc.

It is impossible to dissociate teaching from research; the best preparation for teaching is some early years spent in investigation, which, indeed, should vitalize the teacher's whole career. Nine of the scholars are now engaged in teaching agriculture at home. These include men of such distinction as H. A. D. Neville [1911], Professor and Dean of the Faculty of Agriculture at the University of Reading; J. A. Hanley [1912], Principal of the Royal Agricultural College, Cirencester, and Chief Advisory Officer in the Bristol Province; J. Hunter-Smith [1913], Agricultural Organizer for Herts; W. Brown [1913], Assistant Professor at the Imperial College of Science; H. Raistrick [1913], Professor of Biochemistry at the London School of Hygiene; J. L. Evans [1913], Agricultural Organizer for Hereford, etc.

Five of the scholars are now concerned in some commercial horticultural enterprise at home or abroad. J. W. Lesley [1911] is on the staff of the State Experimental Station in California.

Of the rest, four lost their lives in the War, amongst them one at least of great promise—Philip Bailey [1911], who was gathering up a great body of information about the inheritance of wool characters. Two others have died, and no information is available concerning three of the number.

It will be agreed as regards these pre-war scholars that the record of their after-career affords a full justification for the scheme under which they were appointed. Save for the small minority of three untraced, all the others now living are engaged in the service of agriculture, either as research workers, technical advisers or teachers. About one-third are in our home research stations, and one-fifth of the whole are in similar institutions belonging to the Empire. Further, the proportion of those devoted to research who have distinguished themselves by original work is high, especially if we consider that none of the men is much over forty, and that in most cases war service of some kind or other took no small fraction of the period since the first scholarships were awarded.

1919-28.—When elections were resumed in 1919, 12 men were awarded exhibitions for one year only, and obtained no foreign experience. The limited period of training was dictated by the emergency. The men themselves, although their education had been interrupted by the War, were hardly prepared to wait much longer before embarking on their career, and at the same time the institutes and agricultural colleges were anxious for men. The Government had provided funds for a programme of expansion, and on all sides there was a demand for staff. The record of these 12 men does not suggest that they have allowed the restriction of their training period seriously to handicap them. One is Director of the Flour Millers' Research Association, a second Professor of Agriculture at Lyallpur, two are agricultural chemists in African colonies, the others are in research institutes—with one exception, who has exchanged agriculture for metallurgy and is manager and technical adviser to a manufacturing firm in the Midlands. In 1920, the elections resumed their accustomed form, but it is noticeable that the tenure has generally been shorter than before, and in many cases the scholar did not proceed to any study overseas. Often an appointment offered before the scholar had completed the three years of his scholarship, while in the earlier years of the period under review there were not the same opportunities

for work in Continental laboratories. It would be unfair to the men concerned to discuss them individually, since they have not had the time in which to distinguish themselves and make their quality felt, but taking the post-war scholars as a whole, they have distributed themselves in much the same way as the earlier group. Of the 49 under review who were elected in the years 1919-25, 24 are engaged in the British Research Institutes or in the Advisory service, 8 are in the Dominion or Colonial services, 7 in the Educational service. Six have been engaged by one or other of the great agricultural corporations, and one has a post in the Ministry of Agriculture. In three cases information of the after career is not available ; these include the only case in the record of a scholarship being withdrawn owing to an adverse report on the work of the recipient.

Women Scholars.—Though men only have been mentioned the scholarships have from the outset been open to women, of whom two were appointed in the pre-war group and two others in the 1919-25 group. Three of these women are now engaged in the research institutes, and one is a lecturer in the University of Liverpool. Since 1925, four women have been granted scholarships. On their University records, *i.e.*, at the time of application for scholarships, it is possible that women might be regarded as entitled to a larger proportion of the awards, especially in the botanical group of subjects. Some consideration has to be given, however, to the openings available for a career afterwards, and fewer opportunities are open to women.

As far as the research institutes are concerned, it is a matter of indifference whether the junior worker who joins is a man or a woman. So often one may say of junior assistants that the woman gives better service than the man, because she is keener and has fewer distracting interests, but in the field of research the man matches the woman because only those who are really keen are drawn towards research. However, research institutes engage, necessarily, more junior workers than they can ultimately provide for ; they count upon a steady withdrawal, after a few years, to education, the advisory services, the colonial services, or to businesses calling for experts—all openings which are not available for women. This reduces very markedly the opportunities for the employment of women, either immediately on the termination of their scholarship or after they have been given a junior appointment in a research institute.

The Future.—The scholarship scheme is still in operation, about 10 being awarded in each year. This number would no more than repair the normal wastage in the institutes, and by no means provides for the expansion that is still going on, or for the demands that the great industrial firms are making for trained men. There would, indeed, be a case for increasing the number elected annually, even though the Colonial Office and the Empire Cotton Corporation are now giving similar scholarships. But the difficulty lies in finding a sufficiency of good material from the Universities, particularly in the biological subjects. It is now well recognized that a vicious circle has been set up: the schools neglect biology, with the consequence that the biological classes in the Universities are undermanned; whence, again, follows a lack of teachers for such schools as wish to give more attention to biology. Now that the deficiency has been fully recognized, consideration is being given to the means whereby it may be repaired, as, for example, by the institution of scholarships from the schools to the Universities. The need is a very real one, since the Empire, considered as a whole, is dependent upon agriculture, and the development of agriculture rests upon the growth of biological knowledge. Deliberate steps are necessary to enforce this point of view upon those responsible for education, because English life is becoming every year more urbanized, and English boys less and less acquire the instinctive familiarity with the countryside that produces naturalists, and in turn biological men of science. Meantime, the Development Commissioners' scheme of 1911 has to its credit the training of 100 members of the scientific staff of the Empire.

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IMPERIAL BUREAU OF ANIMAL NUTRITION *

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Origin of Bureaux.—The origin of the new Imperial Agricultural Bureaux has already been dealt with in a previous article in this JOURNAL. It will be sufficient for the present purpose to recall that the Bureaux originated in the Imperial Agricultural Research Conference of 1927, and that they are the natural outcome of the post-war movement towards co-operation between the different Governments of the Empire in the investigation of economic and biological problems of common interest.

Functions of the Bureau of Animal Nutrition.—The functions of this Bureau are as follow:—

(1) The collection of information on research in animal nutrition and allied subjects in different parts of the Empire, and the compilation and maintenance of an index of this research.
(2) The collection of all available information from scientific literature and other sources bearing on problems of common interest and importance.
(3) The distribution of this information, in replies to queries, by circulated memoranda, or by such other means as may seem most suitable.
(4) In addition to this collection and distribution of information the Bureau may facilitate exchange of workers, especially by supplying information with regard to the centres between which exchange would be most profitable, and it may assist in arranging meetings of workers interested in the same problems.

The Bureau does not carry out research, nor does it offer suggestions for new schemes of work or criticism of existing schemes. If, however, an opinion or criticism be asked on any subject it may be given, and, with the consent of the inquirer, if the matter be of sufficient importance, the Bureau will endeavour to get, through its official correspondents or otherwise, the advice of leading authorities on the subject, in whatever part of the Empire they may be. It will be seen that the Bureau is essentially a clearing house for existing information, a centre through which a research worker or administrative officer can obtain information bearing on the problem on which he is engaged, and also, if he wishes, the

* For previous articles in this series see *Imperial Agricultural Bureaux*, Vol. XXXVI (August, 1929), p. 461; *The Imperial Soil Bureau*, *ibid.* (January, 1930), p. 925; *Imperial Bureau of Animal Genetics*, *ibid.* (March, 1930), p. 1149.

constructive criticism and advice of his colleagues in other parts of the Empire who are engaged on similar work.

Scope of Work.—These are the functions of the Bureau. Let us now consider the scope of its work. It must cover (1) the raw materials of the industry of animal husbandry, (2) the mode of transformation of these, and (3) the study of the animals themselves, both as transformers and as end-products. This industry, which is engaged in the transformation of herbage and other materials into animal products for human use, is probably the greatest industry in the Empire. The following figures give an indication of its economic importance. In the United Kingdom, the value of animal products sold annually from farms is £203 million. This is over 70 per cent. of the total revenue from agriculture. The total annual exports of animal products from the Dominions and Colonies to this country is approximately £82½ million. This great industry is being further developed. Animals with a high capacity for production are being evolved; new foodstuffs are being brought into use, and, in overseas parts of the Empire, great areas of natural pastures, which in recent times supported only wild animals, are now being used for grazing cattle and sheep. These developments are raising many difficulties in connexion with feeding which increase the already large number of problems in animal nutrition awaiting solution.

With regard to the mode of transformation and the study of the animal, great advances in our knowledge have been made during the past 20 years. The science of nutrition has accumulated a mass of information which has been termed "the newer knowledge," and which is of potential value for the solution of practical problems. This information is already beginning to be used by the industry. The Bureau should be able to bring together all such scientific information on subjects of common interest and to facilitate the rapid exchange of ideas and results between workers in different parts of the Empire engaged in similar investigations.

In addition to the ordinary difficulty of rapid communication of information due to the distance between these workers, there is, in the case of animal nutrition, the further difficulty that, so far as the British Empire is concerned, it is practically a new branch of agricultural research. There is no organized group of experts in animal husbandry within the Empire. In the case of animal health there is the veterinary profession which has its own publications, and the members of which

are known to each other through their associations. In soil science there are, in every Dominion or large Colony, recognized experts, a considerable proportion of whom are directly or indirectly already in touch with Rothamsted, where, indeed, many of them have been trained.

In animal nutrition, the work is being done by agriculturists, veterinarians, medical men and others who have not yet established themselves as a group, or made the contacts necessary to facilitate the exchange of information. This might be illustrated by considering the work going on at several centres on iodine and endemic goitre, which is believed by many to be due to deficiency of iodine. In Canada practical experimental work on the elimination of goitre in animals by the administration of iodine has been done by Rothwell and other experts in animal husbandry. In New Zealand, Andrew is working at analytical methods, the difficulties in connexion with which have seriously hampered research work on this subject, and Andrew and Shore are determining the amounts of iodine present in different types of soils, and attempting to correlate the amounts present with the incidence of goitre in school children. In Australia, in a scheme of work initiated by the late distinguished biochemist, Brailsford Robertson, the correlation between the iodine content of the thyroids of sheep and the occurrence of goitre in these animals is being investigated. In India, McCarrison is doing fundamental work on the cause of goitre in natives in certain districts. In Aberdeen the rôle of iodine in the nutrition both of farm animals and human beings is being studied. In Nigeria, observations are being made on goitre in natives and animals and on the influence of iodine in preventing it. There are thus medical men, veterinarians, physiologists, biochemists, analytical chemists, soil experts and animal husbandmen all engaged on different aspects of what is essentially the same problem, viz., the rôle of iodine in animal nutrition. The workers belong to different scientific groups, and the results are published in different groups of scientific journals. If all this knowledge, some of which may not be published for years, could be brought together and made available for all workers, especially for those beginning to work at the subject in parts of the Empire where it is difficult to obtain even the published information, the achievement of results of immediate practical value would be greatly facilitated. It is the business of the Bureau to mobilize this information and make it available.

This illustration shows the difficulty of bringing together, and making available for workers in different parts of the Empire, all the existing information on one subject. Success depends on the whole-hearted co-operation of research workers and others in putting at the disposal of the Bureau such information as they have and consider may be of use to their colleagues in other parts of the Empire.

The example chosen is only one, and neither the most important nor the one in which most workers are interested. There are so many major problems common to different parts of the Empire that it would be quite impossible for the Bureau to undertake immediately the collection of information on all of them. The most it can hope to do for the first two or three years is to choose one or two of the problems which the official correspondents consider to be of the greatest common interest and importance, and collect information on these.

Work now in Progress.—The Bureau came into being in April of last year. It was attached to the Rowett Institute. At this Institute there was already in existence the Reid Library which, on a limited and local scale, was working along lines similar to those proposed for the Bureau. With the consent of the committee controlling the library, the Bureau was housed there, and the existing accumulated information and facilities for work were put at its disposal. Mr. Thomson, the librarian and statistician, and Dr. Leitch, who had experience in abstracting scientific literature, were appointed to the staff, and Mr. Crow was seconded from the Scottish Office to assist in the administrative work.

The first work of the Bureau was to get in touch with senior research workers and administrators, both at home and overseas, who are interested in animal husbandry. A circular letter was issued describing the Bureau and asking for a statement of the research work in progress or contemplated. Eighty replies have been received, covering practically the whole of the Empire. The response to this request for information has been most gratifying. The replies have given the information asked for, and in most cases have also indicated an interest in the work of the Bureau and a willingness to co-operate.

The information contained in these replies is now being arranged to form an index of research in animal nutrition for the Empire. This index, when complete, will be circulated to all official correspondents for their comments and suggestions

with respect to the subjects which should be regarded as of greatest importance and common interest, and therefore those on which the Bureau should concentrate attention.

In the meantime information is being collected on the relationship of diet to susceptibility to disease, which is known to be a subject of interest to many research workers. In addition to this collection of information on a fundamental subject, papers dealing with feeding experiments on farm animals are being abstracted and arranged.

As a special piece of work a survey of the present position of animal husbandry within the Empire is being made by Mr. Duckham, who was formerly engaged, at Cambridge University, on a survey of the pig industry in this country. This survey of animal husbandry will give, for each Dominion, Colony and Protectorate, such information as the number of each class of animals, the total production of milk, wool, carcasses, eggs, etc., the exports and imports of these, the chief factors which favour or limit development of the industry, and the main research activities. The co-operation of the Bureau of Animal Health and the Bureau of Genetics is being obtained to make this survey more complete, so that in dealing with research and the possibilities of development it will take account of the three main aspects, viz., feeding, breeding and disease.

In addition to these main lines of work, the Bureau is endeavouring to make itself useful by finding and supplying information asked for, and by placing such information and facilities for study as the Bureau already possesses at the service of men from overseas visiting this country, either on leave or for short courses of special study.

The Development of the Work.—From what has been said with regard to the scope of work of the Bureau and the difficulties to be overcome, it is obvious that it will take several years to build up an organization and accumulate the great volume of indexed information required to enable the Bureau to function efficiently. Although the work is being pushed forward with all possible speed, it is recognized that the first two years are bound to be an experimental period, and hence organization and methods are being kept as fluid as possible to allow of modification in the light of experience. In 1932, the Imperial Agricultural Research Conference will meet in Australia. Most of the official correspondents of the Bureau will attend that Conference, and it will be possible to get the united wisdom

of these in drawing up a scheme of development from 1932 onwards. The work can then proceed more rapidly, with a feeling of assurance that the Bureau is developing in accordance with the wishes of the majority of the research workers in the Empire, and on lines which will enable it to give the maximum amount of service.

In conclusion, it is of interest to consider what effect all the Bureaux will have in bringing together, by correspondence or meetings, research workers and administrators from different Governments in the Empire for the consideration of problems which affect the Empire as a whole. It is probable that the incidental influence of the Bureaux in consolidating the Commonwealth of Nations which make up the British Empire may turn out to be of as much importance as their influence in applying science to its economic development.

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INSECTS IN RELATION TO POTATO VIRUS DISEASES

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DURING the last decade, the attention of both plant- and animal-pathologists has been attracted by the steadily increasing importance of a group of diseases, of unknown cause, which are referred to loosely as "virus diseases." These disorders attack a wide range of plants and animals, not excluding man; and they exhibit a number of points in common, justifying their inclusion in a group by themselves.

Nature of Virus Diseases of Plants and how they differ from Bacterial or Fungal Diseases.—It will be convenient here to examine a few characteristics of these virus diseases and see how they differ from maladies of known origin due to the attacks of harmful bacteria and fungi. In 1892, Iwanowsky discovered that the juice of a tobacco plant affected with the "Mosaic" disease could be passed through a porcelain filter and still retain its power of infecting healthy tobacco plants. This capacity of the infective principle to pass through a porcelain filter, the pores of which are too small to allow the passage of the causal organisms of bacterial and fungal diseases, is one of the chief characteristics of the virus, or "filter-passing," diseases. If, then, bacteria are referred to as "the world of the infinitely small," viruses may justly be termed "the world of

the infinitely smaller." It has been said above that the cause of virus diseases is as yet undiscovered. This is partly because of the difficulties inherent in dealing with an entity which is too small to be seen by the most powerful microscope, and partly because it is not possible to cultivate any virus upon artificial media outside its plant or animal host, as can be done with the majority of fungi and bacteria.

Most virus diseases are of an infectious nature and can easily be transmitted from a diseased organism to a healthy one. It is not necessary to labour this point in regard to the virus of animals that causes "foot-and-mouth" disease, the infectious nature of which is only too well known. Luckily for the agriculturist, the viruses of plants are not so easily disseminated, although they also can be very infectious to healthy plants, and may be spread rapidly in nature by methods which will be dealt with in a later paragraph. As already mentioned, viruses attack plants of all kinds, but it is in relation to the potato plant in particular that they will be considered here. The virus diseases of the potato have existed from very early times, although their true nature was not recognized in those days. It has long been known that a potato variety, if grown in one place year after year without change of "seed," gradually "degenerates" until it has to be replaced by a fresh stock or variety. It is now realized that such "degeneration" of the potato is due to contamination with one or more viruses, and not to mere continuous propagation from the same stock. There is probably no reason why a variety of potato should not be grown indefinitely from its own "seed" in one locality if the virus factor could be eliminated.

Some Common Potato Virus Diseases.—There are several virus diseases of the potato, but only those which occur commonly, and are of economic importance, will be discussed here. The most widespread of them is undoubtedly that known as "Mosaic," the symptoms of which consist of a light and dark mottling of the leaf, sometimes accompanied by a slight puckering of the leaf surface. The Mosaic virus is present in about 90 per cent. of the potato stocks of this country, and, in some varieties, it has become almost a varietal characteristic. A closely-allied disease, and one belonging to the "Mosaic" group, is that known as "Crinkle." Here the symptoms of Mosaic are present in an intensified form; the mottling is bolder, the leaf surface is more puckered and the margins of the leaves are crinkled or waved. A third disease, also of the Mosaic

type, is that known as " Streak " ; this can be, and frequently is, of a most serious and deadly character. It resembles, perhaps, more than most virus diseases do, certain maladies caused by bacteria. Its symptoms take the form of numerous dark brown spots or lesions on the leaves, and may or may not develop into the form known as " Leaf-Drop-Streak," where the leaves shrivel up and drop down one after the other, finally bringing about the death of the plant. Streak is the most perplexing of all the potato virus diseases ; it is often found associated with either Mosaic or Crinkle, and its precise connexion with these two virus diseases has not yet been determined.

The last virus disease of the potato to be considered is of an entirely different type and, when it occurs in quantity, is the most serious from the agriculturist's point of view. This disease is known as " Leaf-Roll " and is so-called because the leaves of an affected plant become harsh and leathery, and the leaflets roll up in a characteristic manner. A badly " rolled " plant (Fig. 1) is a pitiful object; it is small and stunted, and its leathery leaves rattle in the wind, while the yield of tubers from such plants is, as may be imagined, entirely negligible. All the viruses pass down into the tubers, and are thus carried on from year to year.

Some Common Potato Insects and the Part played by them in the Dissemination of Potato Viruses.—Mention has been made of the infectious nature of potato virus diseases and their spread to neighbouring healthy plants in the field. How, then, can this be brought about ? To consider artificial methods of transmission first, diseases of the Mosaic group can be transmitted from a diseased potato plant to a healthy one either by inoculation of the juice by needle scratch or by grafting a scion of a diseased plant on to a healthy stock. The Leaf-Roll virus on the other hand cannot be needle-inoculated from a diseased plant to a healthy one, but can be transmitted by grafting. Obviously, however, since these are artificial methods of spread, it cannot be by them that infection is disseminated in nature. There must be a third method, and a very efficient one, to account for the universal distribution of potato viruses. What is the counterpart in nature of the inoculating needle of the laboratory ? The answer to this question is that one or more of the insects which feed upon the potato plant, in so doing, transmit the infective principle or virus. There are many insects which normally live upon

the potato plant, and it will be necessary briefly to consider these in their relation to the potato viruses.

Insects can broadly be divided into two groups, according to their methods of feeding, viz., (1) those that eat the leaf substance and are known as " biting " insects, examples of which are caterpillars, beetles, etc., and (2) those that have no " jaws " in the accepted sense, but suck the plant sap by means of a hollow, needle-like proboscis, which is inserted into the plant tissue. These are known as " sucking " insects, and the best-known example of this class is the green-fly or aphis of the rose. Although biting insects may be found to transmit the virus diseases of other crops, it is with the latter class only that we are concerned in dealing with the viruses of the potato.

There are three main types of sucking insects which attack the potato plant : (1) the green capsid bug, closely allied to the apple capsid, (2) the leaf-hopper, a small, active, black and yellow or pale green creature, and lastly (3) the aphis or green-fly. The first problem, then, to be solved is—which, if any, of these insects is capable of transmitting the virus ? Study of plant viruses and their insect-transmitting agents has revealed the interesting fact that there is usually one particular species of insect that appears to possess an affinity for a particular plant virus, and this virus can be carried by no other insect. Careful experiments with all the sucking insects of the potato have revealed a state of affairs of this kind. The writer's experiments have shown that one particular species of aphis possesses a marked affinity for several of the potato viruses, and will carry them from diseased to healthy plants with great efficiency ; this applies especially to the virus of Leaf-Roll. The other insects, such as the capsid bugs, leaf-hoppers, and the remaining species of aphides, have failed to transmit the diseases. It may be well to mention here that the mere feeding of the capsid bugs on the potato plant does cause some injury to it which shows itself in the destruction of the young shoots and the production of a " shot-hole " effect on the older leaves. This condition, known as " stung " in some parts of the country, is due to certain toxins in the insect's saliva, but has no connexion with virus diseases.

The aphis referred to, known as *Myzus persicae* Sulz., is a small green species, smaller than that usually found on roses. Like other aphides, it occurs in both winged and wingless forms, the winged form being green with black markings. It can be recognized by the shape of the " cornicles " or " siphons " on the back, which are swollen at the ends. Unfortunately

M. persicae is an exceedingly common insect; it is practically cosmopolitan, occurring over almost all the world, and it is able to feed upon very many plants of widely differing families. This aphis is concerned also in the transmission of other plant viruses and is likely to develop into an insect of world-wide importance. It has been proved by the writer to transmit no less than five virus diseases of the potato. Both winged and wingless forms can carry infection, but the winged form, of course, is able to disseminate the virus over a wider field.

What is the mechanism by which the virus is brought from diseased to healthy plants? As already explained, the aphis feeds by thrusting its sucking beak into the plant tissue. This beak is provided with two channels, down one of which flows the insect's saliva which mixes with the plant sap, and up the other, drawn by the action of a pharyngeal pump, flows a mixture of sap and saliva. Fig. 2 is a photo-micrograph of the beak of a sucking insect *in situ* in the tissue of a potato leaf, and illustrates this method of feeding. At the apex of the beak is seen a boat-shaped body which is a drop of saliva, *s*. Thus, it will be understood that an aphis which has sucked up some sap from a virus-infected plant and then moves on and feeds upon a healthy one acts as a kind of animated hypodermic needle, and injects the virus along with its saliva.

This explanation is quite straightforward, so far as the Mosaic group of diseases is concerned, because it is known that these are transmissible by the needle. It is not quite so clear, however, with Leaf-Roll, a disease which cannot be transmitted by needle, but is very easily transmitted by *M. persicae*. Here is a case where there may possibly be some essential connexion between the Leaf-Roll virus and its insect carrier. It may be that the virus undergoes some slight modification within the body of the aphis, and that this must happen before the virus can become infective to a new plant. In this connexion the following points, which have been disclosed by recent experiments, are of interest. It has been found that *M. persicae* which has been feeding for some days upon a potato plant affected with Leaf-Roll, if allowed to feed for two hours upon a healthy potato plant, will transmit the virus in that time, the plant developing symptoms, under glasshouse conditions, ten to fourteen days later. Conversely, *M. persicae* from a cabbage or some such immune and thus non-infective plant will pick up the Leaf-Roll virus from a diseased potato plant in six hours. The whole process of infection of aphis and healthy plant, however, cannot be performed in eight hours. There

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FIG. 2. Photo micrograph, showing beak of a sucking insect *in situ* in the tissue of a potato leaf.

Note the saliva at left end of line marked "S."

FIG. 3. An example of virus-carrying by the weed Black Nightshade (*Solanum nigrum*). This plant shows no symptoms of disease.

FIG. 1.—Potato, variety "Edzell Blue," infected with Leaf Roll by the aphis *Myzus persicae* Sulz.

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seems to be a minimum period of about 54 hours before the non-infective aphis can become infective to a healthy plant. This may mean that there is some relationship between the virus and its insect carrier, or it may merely be the time necessary for the virus to travel round the body of the insect and return via the salivary juices. Further investigation of this point is necessary before any dogmatic statement can be made. The practical point arising, however, is that *M. persicae* can infect a healthy potato plant with Leaf-Roll after feeding for only a very short time.

It has been shown that healthy potato plants may become infected in the field with virus diseases brought to them by the aphis, *M. persicae*, from neighbouring diseased plants. There exists, however, another opportunity for infection which should not be overlooked. Besides feeding on the growing plant in the field, *M. persicae* is also a sprout-infesting aphis, and is often found feeding upon the shoots of "seed" tubers in the sprouting trays. By feeding infective aphides upon the shoots of known healthy tubers in February, the writer has produced a crop of badly "rolled" plants at the end of March. The plants in this case were grown in a glass-house, but the effect would have been the same, though delayed, if they had been planted in the field. Thus it is possible for the virus to become distributed to a considerable extent among the sprouted tubers, and for healthy "seed" tubers to become infected before they are planted in the ground.

Plant "Carriers" of Virus Disease and Sources of Infection in Nature.—The investigator working upon virus diseases of the potato is seriously handicapped by the existence of certain varieties of potato which behave abnormally in their reactions to virus diseases and which may be termed "carriers." Put briefly, this means that these potato plants, although outwardly perfectly normal and healthy, yet carry in their sap one or more potato viruses. That is to say, the virus exists in a quiescent yet infective condition within the "carrier" plant, which itself exhibits no disease symptoms. If a scion from such a plant be grafted on a healthy plant of another and susceptible variety, the disease develops in the latter, although the scion continues to show no symptoms. Parallel cases of "carrying" may be quoted in certain diseases of man: typhoid, for example, though of microbic origin and not due to a virus, is sometimes carried by a person who, himself healthy, is capable of infecting other and susceptible persons.

FIG. 4. Potato, variety "President," infected with Crinkle and Leaf-drop Streak by means of the aphis *Myzus persicae*, which brought the infection from the virus-carrying weed shown in Fig. 3.

Here, then, is a very serious complication for the potato virus worker, who must first of all discover whether his potato plants are free from hidden viruses before any scientific studies can be made. Apart from this, however, the existence of these plant "carriers" is of practical importance. It is quite possible that such potato plants may act as reservoirs of infection in nature, from which the aphis can transmit disease to neighbouring healthy but susceptible varieties. In the present state of knowledge of this subject, however, it is not possible to state exactly to what extent the aphis can infect susceptible potato varieties from "carrier" plants. Should infection be carried in this manner—and experiments are under way to determine the point—it will be a matter of great importance. In the future it may be proved to be as bad agricultural practice to grow certain varieties of potato in close proximity as it is known at the present moment to be to grow wart-susceptible potatoes in wart-infected soil.

It should be realized that a "carrier" plant is quite a different thing from an "immune" one. The potato varieties which are really immune from wart disease, for example, do not take the disease at all, and the wart organism cannot live within them. In a virus carrier, however, the plant has the infective principle within itself, but, for some reason, is tolerant of it and shows no unusual symptoms. Such a plant though "carrying" one virus is quite likely to be susceptible to or intolerant of another. The virus most frequently "carried" is that which produces "streak," and a well-known Streak-carrying variety is "Up-to-Date"; but this variety can be infected by, and show symptoms of, both Mosaic and Leaf-Roll.

So far, no potato variety is known which is immune from virus diseases, though there exists a wide range of difference in varietal susceptibility and in reaction to the different diseases. Recent work at Cambridge has revealed the existence of reservoirs of virus infection other than the potato itself. It has been found, for example, that the common Solanaceous weed, Black Nightshade (*Solanum nigrum*), is not only frequently infected with certain potato viruses, but is an almost perfect "carrier" of such viruses, exhibiting no symptoms other than a faint mottling of the leaves which disappears with the continued growth of the plant. Fig. 3 shows such a virus-carrying Black Nightshade; this plant when photographed appeared absolutely healthy and symptomless. Again, the Black Nightshade is a common host of the virus-carrying aphis *M. persicae*, so that all conditions necessary for the

transmission of infection are fulfilled. Experiment has proved that in this case, at least, the aphis can transmit infection from a "carrier" plant to healthy, susceptible varieties of potato. In the glasshouse some individuals of *M. persicae* were colonized upon a plant of Black Nightshade suspected of harbouring a virus; after a few days' feeding they were transferred to healthy potato plants, *var.* "President." In about ten days the "President" plants developed a very serious disease the symptoms of which took the form of a severe crinkling of the uppermost leaves, together with Streak in its leaf-drop form (*see* Fig. 4). The experiments were then repeated, but this time *M. persicae* was collected, together with other species of aphis, from various Black Nightshade plants growing among a potato crop nearby. The aphides were then transferred, as before, to healthy potato plants. In nearly every case the potatoes colonized with *M. persicae* developed the Crinkle and Leaf-Drop disease, while in every case the potatoes colonized with the other species of aphis from the same Black Nightshade plants remained healthy. In one instance a single, winged female of *M. persicae*, transferred from a Black Nightshade plant in the field to a healthy potato plant, was sufficient to infect the latter with the Crinkle and Streak disease and render it entirely useless for tuber production.

The degree of importance which attaches to this discovery depends to a certain extent upon two points. Firstly, is Black Nightshade capable of acting as a biennial weed, and, secondly, is the virus carried by the seed? Either of these factors would ensure the retention of the virus until the following year. The Black Nightshade must first itself become infected by the aphis from a virus-infected potato before it can act as a reservoir of infection. Although the fact of such virus-carrying weeds growing in the midst of an already infected potato crop is important, yet it is obviously more important if a new and possibly virus-free crop of potatoes should be planted the following year among or even close to numbers of virus-carrying weeds. There is little doubt that Black Nightshade does act as a biennial weed; it also seems to produce fresh plants from pieces of root-stock left in the ground over winter, and such plants would, of course, contain the virus, for it is present in every part of the plant. The question of transmission through the seed is more doubtful, as plant viruses are not often transmitted in this manner.

It is thought that one of the chief reasons for the comparative

freedom of much Scottish "seed" from virus disease is the scarcity of the aphis carrier in that country. Therefore, if stocks of virus-free tubers could be raised in England under insect-free conditions, there seems little reason why they should not be equally as good as Scottish "seed." Large stocks of virus-free potatoes are accordingly being raised under insect-proof conditions at the potato virus station at Cambridge by Dr. R. N. Salaman, and if these can be propagated further, on a commercial scale in English localities, under conditions where infection cannot occur or is at any rate reduced to a minimum, the problem of supplying English growers with satisfactory home-grown "seed" will be solved.

As regards prevention of infestation of the sprouting tubers in the seed trays by *M. persicae*, it is well worth while to fumigate the store or shed containing the trays twice a week. This can easily be done by heating a small quantity of pure nicotine in a metal saucer on a tripod over a spirit lamp. As regards the elimination of diseased plants in the field, something may be done by "roguing" out affected plants as soon as symptoms appear. This method, however, is practicable only with a virus disease like Leaf-Roll, where the symptoms are obvious and easily recognizable, and where the complications of "carriers" with suppression of symptoms are less likely to occur.

It will be realized, even from such a brief article as this, that the potato virus problem is a complicated and important one, and that its solution is yet far to seek.

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MARKETING NOTES

National Mark Eggs.—During April, approximately 24 million eggs were passed through the authorized packing stations, of which 17 million were packed under the National Mark. Many packers have utilized a proportion of their April supplies of eggs for preservation. The effect of this diversion of supplies was to relieve the markets to some extent during the flush season.

It is noteworthy that the considerable improvement in the quality of supplies received by the packing stations, which was referred to in the May issue of this JOURNAL, is being maintained. It must be pointed out, however, that the time of year is now approaching when eggs tend to decline in quality, and producers should therefore bear in mind the need for regular and frequent collection of supplies, and for dispatching them in a fresh and clean condition. It is upon the co-operation of producers in such matters that the ultimate success of the National Mark scheme largely depends.

Quotations in the daily press of prices of National Mark eggs at Smithfield Market have now been discontinued, and their place has been taken by quotations supplied by National Mark Egg Central, Ltd., from the returns of their London accredited agents. Prices are notified daily to the headquarters of National Mark Egg Central, Ltd., and are transmitted via the Ministry to the Press. The Ministry was successful in arranging for the immediate substitution of the official prices for the Smithfield prices when the latter ceased publication, thus causing little or no inconvenience to egg traders. The quotations are also appearing in the Ministry's Agricultural Market Report and in the Weekly Dairy Produce Notes of the Empire Marketing Board.

National Mark Beef.—The number of sides of beef graded and marked with the National Mark each week since the week ended April 5, 1930, has been as follows :—

Week ended	*Select*	*Prime*	*Good*	*Total Sides graded and marked. (Quarters and pieces omitted.)*
		LONDON		
April 12 ..	945	1,157	56	2,158
,, 19 ..	912	1,145	99	2,156
,, 26 ..	764	982	82	1,828
May 3 ..	934	1,195	59	2,188
		BIRKENHEAD *		
April 12 ..	3	85	6	94
,, 19 ..	—	72	—	72
,, 26 ..	7	81	—	88
May 3 ..	3	72	—	75

Week ended	Select	Prime	Good	Total Sides graded and marked. (Quarters and pieces omitted.)
		SCOTLAND *		
April 12 ..	2,432	344		2,776
,, 19 ..	2,388	320		2,708
,, 26 ..	2,270	393		2,663
May 3 ..	2,234	358		2,592
		TOTAL LONDON SUPPLIES (All sources)		
April 12 ..	3,380	1,586	62	5,028
,, 19 ..	3,300	1,537	99	4,936
,, 26 ..	3,041	1,456	82	4,579
May 3 ..	3,171	1,625	59	4,855
		BIRMINGHAM		
April 12 ..	132	293	28	453
,, 19 ..	151	259	23	433
,, 26 ..	112	285	13	410
May 3 ..	141	237	13	391

* Sides consigned to London.

A third publicity campaign was undertaken by the Ministry during May in the Finchley, Hendon, Southgate and Willesden districts of North and North-West London, and in the North and South Erdington and St. Mary's Divisions of Birmingham. A letter signed by the Minister was addressed to over 50,000 women householders in North and North-West London, and to about 15,000 in Birmingham, appealing to them, when buying home-killed or Scotch-killed beef, to insist on being supplied with National Mark beef. With the Minister's letter was enclosed, in the case of London, a list of local butchers on the roll of meat traders regularly stocking graded and marked beef, and, in the case of Birmingham, a list of butchers in the City known to be regularly selling National Mark beef.

During the past month, the figures of graded and marked sides for the London area for the first time exceeded 5,000 in a single week, which is proof of the satisfactory growth of the Scheme. A high percentage of "Select" and "Prime" has also been maintained. Wholesalers, in fact, state that it is comparatively difficult to dispose of sides which can only be put into the "Good" grade. On the other hand, the demand for "Select" is greater than the supply, all classes of butchers being anxious to show, at any rate, some "Select" grade beef in their shops.

In the last few weeks a number of carcasses have had to be classed as "Prime" which would have been "Select" but for one factor—that of excessive fatness. Too high a finish is not wanted even in London, which, on the whole, is one of the

best markets for well-finished cattle. This is clearly shown by the lower prices which over-finished carcasses realize.

It is the opinion of competent observers that, during this spring, the market in "Bright" beef (*i.e.*, home-killed or Scotch) has shown much more resistance than usual to extra pitchings of chilled beef. There have been sudden falls in price in "Bright" beef on one or two occasions, but these falls have been comparatively small. In other years, the "Bright" trade has shown itself much more sensitive to every influx of chilled beef. Thus, while prices may not have risen as a result of the National Mark Beef Scheme, they have undoubtedly been steadier in the period under review.

National Mark Apples and Pears.—The National Mark Scheme for apples and pears has now been in operation for two seasons. While, so far, only limited supplies of fruit of National Mark quality and size have reached the markets, it can be definitely stated that the scheme has successfully attained one objective, viz., the convincing of fruit growers of the need for improving the quality of their produce. A great improvement in the standard of production will undoubtedly be noticeable during the next few years, owing to the impetus which the National Mark Scheme has given in relation to the planting of superior stock. New applications for enrolment as authorized packers under the scheme have been received from growers in all parts of the country.

National Mark Tomatoes and Cucumbers.—The National Mark Scheme for tomatoes and cucumbers has now entered upon its second season, and there is every indication that the amount of fruit packed under National Mark labels and the number of new growers authorized to carry out such packing will show a substantial increase.

National Mark Wheat Flour.—The Ministry of Labour has had under consideration the question of the use of National Mark flour at residential centres conducted under that Department's schemes of training. Arrangements have been made for National Mark flour to be supplied in these centres as soon as the existing contracts expire. In the case of non-residential training centres, where meals supplied to the men in training are provided by private firms under contract with the Ministry, all catering contractors have undertaken to give National Mark flour a trial.

The propaganda undertaken by County Branches of the National Farmers' Union has already resulted in a perceptible strengthening of the demand for National Mark flour in some areas. Propaganda methods include articles in local issues of the *National Farmers' Union Record*, circular letters to farmers, distribution of leaflets, display of posters, and individual canvassing of retailers. Valuable work is being done by district Federations of Women's Institutes; in one case, a stall is being run in the local market.

National Mark Malt Products.—The results are now available of tests made at the Government Laboratory with 32 unselected commercial samples of malt extract with cod-liver oil, taken from some hundreds of jars purchased at random, before the introduction of the National Mark scheme, from retail chemists in various districts, covering practically the whole of England and Wales. The samples were tested for protein content, specific gravity and diastatic activity of the original extract, and for volume of cod-liver oil present, these being essential factors of therapeutic and dietetic value, for which definite standards are laid down in the National Mark Scheme.

The analyses showed that only one sample could comply in all respects with the minimum requirements of the Scheme. The others exhibited the widest divergences, and conformed to no recognizable standard of manufacture or nutritive value. Extreme variations occurred in diastatic activity, *i.e.*, the power of converting starch into sugar. In some of the samples, this property was entirely absent, thus reducing enormously their value for medicinal and nutritive purposes. Only 5 out of the 32 reached National Mark standard in this respect; and 20 per cent. of the samples were deficient in protein content, a similar proportion being of too low specific gravity. Cod-liver oil content varied from 10·8 to 19·6 per cent. by volume, compared with the standard 15 per cent. (with 1 per cent. permissible variation) laid down for the National Mark product.

Apart from the fact that National Mark malt extract is made entirely from home-grown grain, and that its sale is calculated to strengthen the position of home barley growers, it will be seen from the foregoing statement that its intrinsic superiority to ungraded supplies of malt extract justifies its claim to special consideration by the medical profession and by the consuming public.

National Mark Canned Fruit, Peas and Beans.—By the first week in June, a scheme will be in operation for applying the National Mark to All-English Canned Fruits, Peas and Beans. Full particulars of the Scheme are given in a leaflet (Marketing Leaflet, No. 20), copies of which may be obtained, free of charge, on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

The scheme is similar in general structure to earlier National Mark schemes. Regulations* have been made by the Minister, to come into force on June 4, 1930, prescribing grade designation marks and definitions of quality in respect of fruit, peas and beans, grown and canned in England and Wales. The grade designations are :—

Select Dessert Plums, Select Strawberries, Loganberries, Raspberries and Black Currants, Select Dessert Gooseberries, Select Apples, Select Peas and Select Beans.

In the case of plums, apples and peas, the scheme is limited to certain varieties known to be particularly suitable for canning. The definitions of quality provide that all fruits, other than apples, must be packed in syrups with minimum percentages of sugar, and be firm ripe, free from blemish and reasonably uniform in size. Select apples must be packed solid in slices of uniform size and colour in cans of one-gallon capacity. Select peas and beans are required to be freshly gathered at the time of canning and to be of uniform variety, size and colour. None of the canned products under the scheme may be treated with preservatives and/or artificial colouring agents other than those permitted under the Public Health (Preservatives, etc., in Food) Regulations in force for the time being.

Official labels for application to cans will bear the National Mark and the words "National Mark Canned Fruit: Select," or "National Mark Canned Peas: Select," or "National Mark Canned Beans: Select," as the case may be. They will be obtainable on payment, and will be issued to authorized canners by or on behalf of the Ministry of Agriculture and Fisheries. Under certain conditions, authorized packers will be licensed to incorporate the National Mark in the design of private brand labels for application to cans of National Mark Canned Fruit, Peas and Beans, in lieu of the official National Mark labels. Whether applied by means of the official label or as part of a private label under licence of the Minister, the affix-

* The Agricultural Produce (Grading and Marking) (Canned Fruits, Peas and Beans) Regulations, 1930: Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2.

ing of the National Mark with a grade designation to a can of fruit, peas or beans is a guarantee on the part of the authorized canner that the contents accord with the definition of quality applicable to the appropriate grade under the scheme.

Canners who undertake to comply with the procedure and conditions of the scheme are invited to apply direct to the Ministry for authority to apply the National Mark. In granting authorizations, the National Mark Committee is advised by a Trade Committee, consisting of growers, canners, distributors, etc., which is known as the National Mark Canned Fruit Trade Committee, and this will also advise on the general administration of the scheme and with regard to any complaints respecting supplies packed under the National Mark.

The advertising value of the National Mark, together with the guarantee of quality associated with the scheme, should give an impetus to the sale of canned English fruit and vegetables. Owing to the fact that they were early in the field, canned fruits from abroad have a large market in this country, but many of the familiar English canned fruits compare with them in lusciousness and are superior in delicacy of flavour. Canned peas and beans, again, offer many advantages to the busy housewife, and there is no question that English-grown varieties are held in higher esteem than those obtained from abroad.

Displays of Home Produce.—During last month, home produce was displayed at the following exhibitions :—

Bognor Regis Empire Exhibition :	April 29 to May 8.
Manchester Grocers' Exhibition :	April 29 to May 8.
Belfast Empire Exhibition :	May 12 to 17.
Nottingham Grocers' Exhibition :	May 14 to 24.

At the first-mentioned exhibition, the display was devoted entirely to National Mark commodities ; at the others, the displays were of a general character.

Marketing Demonstration.—A fruit marketing demonstration was staged at the Long Ashton Research Station on the occasion of the Station's annual Cider Tasting Day on May 1. The demonstration, which was on the lines of those given during recent years at the principal agricultural shows, attracted interest from an unusually large number of visitors. A new feature of the demonstration was a display of the grades and packages to be used in connexion with the National Mark scheme for strawberries (*see* p. 251).

Butter Marketing : Quality Control.—English farm butter, when well made from properly ripened cream, is recognized as being the finest butter on the home market. There is, however, a considerable range of quality in the farm output as a whole, and, in the absence of any organized grading scheme, its reputation has suffered in the past from lack of uniformity, particularly in respect of keeping properties. In consequence, its market tends to be restricted to the locality of production. With the object of establishing public confidence in the commodity and of widening the market the principle of attaching a trade mark to produce as a guarantee of quality has been adopted by the Devon Butter Producers' Association—an organization recently formed by Devonshire farm butter makers, with the assistance of a grant from the Ministry, for the organized marketing of their butter. This scheme was fully described in this JOURNAL, February, 1930.

It is now learned that a scheme, identical in all its main features with the Devonshire scheme, was inaugurated simultaneously in Bavaria. In the Bavarian scheme, the farms are inspected, ten samples of butter are tested, and, if the results are satisfactory, the maker is registered and is supplied with parchment wrappers for quantities of ¼ lb., ½ lb., and 1 lb., and also with standardized postal cartons bearing the trade-mark of the association. In order to maintain the standard of production, registered members are obliged to submit further samples of their produce for examination from time to time on demand, and to keep their premises open for inspection. Plans are now being made to establish a central co-operative sales organization. This new Bavarian scheme gives added interest to the Devonshire experiment.

Union of South Africa : Public Auctions and Transactions in Livestock and Produce (Amendment) Act, 1930.—To those who have read the Ministry's final Report on Markets and Fairs in England and Wales (Economic Series No. 26)*, the Act which has recently been passed in South Africa to amend the Public Auctions and Transactions in Livestock and Produce Act, 1925, will be of interest. The 1925 Act provided *inter alia* that all sales of livestock by auction should be public, and that the auctioneer should announce at the sale the name of the purchaser and at the conclusion of the auction deliver to each seller a sales-note showing the names of the seller and the purchaser, the number and description of animals sold, and the prices at which sold, specifying the deductions made for commission and other charges and the net amount due to the seller.

* Published by H.M. Stationery Office. Price 6d., post free, 10d.

The 1930 Amendment Act adds clauses under which :—

(a) No auctioneer, agent or factor shall sell agricultural produce or livestock unless he has given a security based in amount upon the volume of business done in the preceding year. The limits of the security are from £500 to £2,500 in the case of livestock sales, and from £200 for produce.

(b) A seller may insist on inspecting the auctioneer's or agent's books or documents in regard to his particular transaction.

(c) In the case of agricultural produce, purchasers, in the absence of any contrary directions given to the auctioneer by the seller, are entitled to purchase from the same consignment any number of units of the same class or quality at the same price as the first unit bought.

(d) When an auctioneer or agent sells agricultural produce at a market controlled by a local authority, he must, within seven days, submit to the seller a statement of the prices realized which must bear the signature or official stamp of the Market Master or person in charge of the market.

Union of South Africa : Packing and Marking of Agricultural Products.—The Government of the Union of South Africa have recently passed an Act, entitled the "Agricultural Products Packing and Marking Act, 1930," prohibiting the sale or offer or exposure for sale of hides and skins intended for export, wool, lucerne, wheat, tobacco, or any other product of farming operations to which the Act is applied, unless such product has been packed and labelled or marked in the manner prescribed by Regulations made under the Act by the Union Minister of Agriculture.

The Regulations may prescribe :—

(1) the manner of packing and the size, description, quality and weight of the materials to be used for packing ;

(2) the manner in which the receptacles shall be labelled, marked or branded ; and

(3) particulars regarding the system of inspection and the fees payable.

Economic Series of Reports on Marketing, etc.—Of this Series of Reports (familiarly known as "The Orange Books") 23 have now been published. As evidence of their popularity and usefulness, it is pleasing to observe that, by the end of March, 1930, 81,252 copies had been sold. The rate at which sales are increasing shows that the value of the Reports is being recognized by an ever-widening circle of producers, distributors and others interested in marketing questions, and it seems certain that, before long, several of the numbers will be out-of-print—some, perhaps, this year. A list of the Reports issued and any further information regarding them may be obtained from the Ministry. The Reports themselves are obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or through any bookseller.

DRESSED POULTRY: GRADING AND MARKING

IN 1926, the Ministry issued its Report on the Marketing of Poultry in England and Wales (Economic Series No. 11*). Since that date, the Ministry has carried out a lengthy series of practical demonstrations at agricultural shows of the technique of conditioning birds for market, of grading the dressed supplies to recognized standards of quality, and of packing to standard methods on up-to-date lines. This instructional campaign was necessitated by the unfamiliarity of many of the ideas and considerations involved, and was preliminary to the introduction of a scheme of marketing reform comparable to the schemes which had previously been introduced, on a national scale, for eggs, fruit and other home products.

The need for a national effort to improve the marketing of home-produced poultry can be seen from the fact that, although from 75 to 80 per cent. of the supplies consumed in this country are of home production, imported supplies, chiefly from European sources, secure a considerable portion of the best trade in our markets. This trade is very largely that of hotels, restaurants and certain classes of shops, which buy poultry regularly throughout the year. Further, imported poultry can be sold on a sample box ; practically every parcel of English poultry, on the other hand, must be unpacked in the wholesale market, examined and sorted into level lots before sale. Finally, the consumption of poultry per head of population in the large towns and cities is comparatively low, and there is every reason to think that it could be increased if supplies were offered in more presentable fashion and—by eliminating waste and inefficiency at every stage—at more attractive prices. As with other home-produced commodities, the problem is essentially one of provisioning the large centres of population in a business-like manner, in order to create a keener demand and a broader market for supplies from our countryside, and so create favourable conditions for a steady increase in home production.

Representations have frequently been made by wholesale distributors to the effect that the high class of produce required by the trade is not produced in any quantity in this country, and that until, by propaganda and education, the standard of production has been improved, any attempt to improve marketing would be premature. This view can be understood, but it cannot be accepted. In the first place, it is certain that

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. Price 6d., post free, 9d.

much of the poorly-finished home-produced poultry of unappetising appearance that is now placed on the market could, before sale, be dealt with in such a way as to remove the distributor's chief objection to it. In the second place, a sound marketing scheme, providing for the assembling of supplies from local farms and markets, encouraging the systematic conditioning of the birds before slaughter, and ensuring the grading and packing of the dressed supplies to national standards, would do more than anything else to bring home, to producers and others, the true nature of market requirements, and would give them a practical objective which, by degrees, would be very generally attained.

The first essentials of a marketing scheme for dressed poultry are (i) the definition of a national standard of classification and quality, involving the standardization of nomenclature, (ii) the definition of standard weight categories, for purposes of packing, and of standard packages and packing methods, and (iii) the recognition in some form of those businesses which undertake to pioneer the scheme, and to equip specialist conditioning and packing plants efficiently.

The National Mark Poultry Scheme, which is designed with these objects in view and has been approved by the various sections of the industry represented on the Poultry Advisory Committee of the Ministry of Agriculture and Fisheries, has been given effect under the Agricultural Produce (Grading and Marking) Act, 1928.

After consultation with the various interests concerned, grade designations and definitions of quality as set out in Table I (p. 246) have been agreed upon for home-produced dressed poultry. These designations and definitions are given statutory effect in the Agricultural Produce (Grading and Marking) (Dressed Poultry) Regulations, 1930, dated June 2, 1930.

Briefly, the regulations prescribe nine grades of chickens, five grades of fowls, three grades of ducks, and two grades each of geese and turkeys, together with definitions of the characteristics associated with the grade designations.

Standard packs and packages which are required to be used with these grades when the National Mark is applied are given in Tables II (p. 244) and III (p. 250).

The National Mark may be applied only to packages containing dressed poultry produced in England and Wales, and to individual birds packed in such packages.

No person may mark any article, covering or label with a statutory grade designation mark (*i.e.*, the National Mark) unless authorized to do so by or under regulations made under the Act, and such authorization can be granted, revoked or suspended only by the National Mark Committee, which has been appointed by the Minister of Agriculture and Fisheries for that purpose.

Procedure and Conditions to be observed by Packers authorized to apply the National Mark.

(*a*) *Output.*—Authority to apply the National Mark will be granted only to packers whose output attains a certain minimum volume, as follows :—

(i) During April and May, sixty dozen birds per month, of which at least fifteen dozen must be packed under National Mark labels.
(ii) From June to December, eighty dozen birds per month, of which at least twenty dozen must be packed under National Mark labels.

The months from January to March, inclusive, are to be "free" months, so far as output qualification is concerned. In the calculation of output under (i) and (ii) above, poussins in the chicken class and turkeys and geese should be excluded.

This requirement is a tentative arrangement, to be reviewed in the light of experience, and is imposed in order to ensure that operations are on a sufficiently large scale to achieve the full advantages of standardization.

(*b*) *Premises and Equipment.*—An authorized packer must possess and maintain, in good order, covered crating capacity for not less than 125 dozen birds ; this represents a minimum floor space for this purpose of between 1,200 and 1,300 sq. ft. The premises must be kept clean, dry and orderly, and all equipment must be maintained in proper working order, to the satisfaction of the Ministry. Equipment must necessarily bear relation to the output qualification and to the process of conditioning which involves crate feeding. It is also desirable that the final preparation for market and the packing should be undertaken on or adjoining the premises used for conditioning.* Adequate accommodation must be available at the one centre for the whole range of processes—namely, conditioning, slaughtering, plucking, shaping, cooling and packing. A packing unit should also be, at least, large enough to keep a skilled man fully employed apart from semi-skilled labour.

(*c*) *Grading.*—Authorized packers shall apply the National Mark only to produce which complies with the definitions of quality prescribed for the grade designations (*see* Table I).

* It will, however, be optional for a packer either to undertake the the whole process of preparation for market, or, alternatively, to accept birds for grading and packing after conditioning by the producer.

TABLE II.—SUGGESTED STANDARD METHODS OF PACKING TO BE EMPLOYED WHERE GRADE DESIGNATION MARKS ARE APPLIED.

Grade Designation.	Weight Group.*	Package and Pack.	Lining Paper.	Declaration of Contents.
CHICKENS				
Poussins "A1" ..	9–12 oz. each 12–16 ,, ,,	Chickens and fowls to be packed in single layers in non-returnable chip or wooden boxes, as laid down in Table III. Birds of the Poussins class to be packed in units of 20 or over (multiples of 4). Small birds of the Asparagus class (*i.e.*, from 1 to 1½ lb.) to be packed 12, 16 or 20 to the box; other classes of Chickens and Fowls under 3 lb. in weight to be packed in units of 1 dozen; those of 3 lb. weight and over to be packed in units of either 1 dozen or ½ dozen. Chickens and Fowls to be shaped in the "Surrey" fashion for the purpose of "Squat" packing—*i.e.*, with legs brought up to the sides of the breast, hocks turned back, wings folded close to the breast.	All chips and boxes to be lined with clean white paper either absorbent or grease-proof, according to requirements.	In addition to the grade designation, the contents of each package to be declared as regards count and net weight. Colour of skin should also be declared—*i.e.*, "White," "Yellow," or "Mixed," as the case may be, except as regards Poussins, Asparagus Chicken and Capons, for which no colour declaration is required.
Asparagus "A1" ..	1–1½ lb. ,, 1½–2 ,, ,,			
Spring Chicken "A1" ,, ,, "A"	2–2½ ,, ,, 2½–3 ,, ,, 3–3½ ,, ,, 3½–4 ,, ,,			
Chicken "A1" .. Chicken "A" ..	2–2½ ,, ,, 2½–3 ,, ,, 3–3½ ,, ,, 3½–4 ,, ,, 4–4½ ,, ,, 4½–5 ,, ,, 5–5½ ,, ,, 5½–6 ,, ,,			
Surrey Chicken "A1" ,, ,, "A"	4–4½ ,, ,, 4½–5 ,, ,, 5–5½ ,, ,, 5½–6 ,, ,, 6–7 ,, ,, 7–8 ,, ,, 8 lb. & over			
Capons "A1" ..	6–8 lb. each 8–10 ,, ,, 10–12 ,, ,, 12–14 ,, ,,			
FOWLS				
Young Hens "A1" .. ,, ,, "A" ..	3–3½ lb. each 3½–4 ,, ,, 4–4½ ,, ,, 4½–5 ,, ,, 5–5½ ,, ,, 5½–6 ,, ,, 6–7 ,, ,, 7–8 ,, ,, 4–4½ ,, ,, 4½–5 ,, ,, 5–5½ ,, ,, 5½–6 ,, ,, 6–7 ,, ,, 7–8 ,, ,, 8–9 ,, ,, 9–10 ,, ,,			
Hens "A"	4–5 ,, ,, 5–6 ,, ,, 6–7 ,, ,, 7–8 ,, ,, 8–9 ,, ,, 9–10 ,, ,,			
DUCKS				
Ducklings "A1" ..	4–4½ lb. each 4½–5 ,, ,, 5–5½ ,, ,, 5½–6 ,, ,,	Ducks to be packed in units of ½ dozen, in single layers, in non-returnable chip or wooden boxes, as laid down in Table III. Ducks to be shaped with feet folded in behind the back and wings to the sides of the breast.		In addition to the grade designation, the contents of each package to be declared as regards count and net weight. Colour of skin should also be declared—*i.e.*, "White," "Coloured," or "Mixed," as the case may be.
Young Ducks "A1" ,, ,, "A" ..	4–4½ ,, ,, 4½–5 ,, ,, 5–5½ ,, ,, 5½–6 ,, ,, 6–7 ,, ,, 7–8 ,, ,,			
GEESE				
Young Geese "A1" ,, ,, "A" ..	8–10 lb. each 10–12 ,, ,, 12–14 ,, ,,	Geese to be packed in units of ½ dozen and shaped with feet folded in behind the back and wings to the sides of the breast. No requirement as to packages yet laid down—*see* Table III.	No requirement.	
TURKEYS				
Turkeys (Young Hens) "A1"	9–11 lb. each 11–13 ,, ,, 13–15 ,, ,, 15–18 ,, ,,	Turkeys to be packed in units of ½ dozen. No requirement as to packages (*see* Table III) or shaping yet laid down.	No requirement.	In addition to the grade designations, the contents of each package to be declared as regards count and net weight.
Turkeys (Young Cocks) "A"	12–14 ,, ,, 14–16 ,, ,, 16–18 ,, ,, 18–21 ,, ,, 21–24 ,, ,, 24–27 ,, ,, 27–30 ,, ,,			

* The Weight Group indicates the minimum and maximum weights permitted for birds packed together in the same package.

TABLE I.—DRESSED POULTRY PRODUCED IN ENGLAND AND WALES—STATUTORY GRADE DESIGNATIONS AND STATUTORY DEFINITIONS OF QUALITY.

Statutory Grade Designation. (1)	Statutory Definition of Quality. Weight Range (Minimum and Maximum). (2)	State or Condition. (3)	
CHICKENS			
Poussins "A1"	9–16 oz.	Milk fed; straight, unbroken breastbone; free from blemishes.	Undrawn, "clean picked" —*i.e.*, the legs, body, wings and half the neck from the base to be free from all feathers and "pin" feathers (stubs).
Asparagus Chicken "A1"	1– 2 lb.		
*Spring Chicken "A1"	2– 4 lb.	Well fattened; skin of fine texture; straight, unbroken breastbone; full breasted; soft and flexible cartilage; free from blemishes.	
*Spring Chicken "A"		Well conditioned; straight, unbroken breastbone; soft and flexible cartilage.	
†Chicken "A1"	2– 6 lb.	Well fattened; skin of fine texture; straight, unbroken breastbone; full breasted; soft and flexible cartilage; free from blemishes.	
†Chicken "A"		Well conditioned; straight, unbroken breastbone; soft and flexible cartilage.	
Surrey Chicken "A1"	4 lb. and over	Crammed; skin of fine texture; straight, unbroken breastbone; full breasted; soft and flexible cartilage; free from blemishes.	
Surrey Chicken "A"		Crammed; skin of fine texture; straight, unbroken breastbone; soft and flexible cartilage.	
‡Capons "A1"	6–14 lb.	Superfat; skin of fine texture; straight, unbroken breastbone; full breasted; soft and flexible cartilage; free from blemishes.	
FOWLS			
Young Hens "A1"	3– 8 lb.	Well fattened; straight, unbroken breastbone; full breasted; flexible cartilage; free from blemishes.	Undrawn, "clean picked" —*i.e.*, the legs, body, wings and half the neck from the base to be free from all feathers and "pin" feathers (stubs).
Young Hens "A"		Well conditioned; straight, unbroken breastbone.	
Cockerels "A1"	4–10 lb.	Well fattened; straight, unbroken breastbone; full breasted; flexible cartilage; free from blemishes.	
Cockerels "A"		Well conditioned; straight, unbroken breastbone.	
Hens "A"	4–10 lb.	Well conditioned; straight, unbroken breastbone.	
DUCKS			
§Ducklings "A1"	4– 6 lb.	Well fattened; full breasted; soft and flexible cartilage; free from blemishes.	Undrawn, "clean picked" —*i.e.*, the legs, body, wings (except the end wing joint) and half the neck from the base to be free from all feathers, "pin" feathers (stubs) and down.
‖Young Ducks "A1"	4– 8 lb.	Well fattened; full breasted; soft and flexible cartilage; free from blemishes.	
‖Young Ducks "A"		Well conditioned; soft and flexible cartilage.	
GEESE			
‖Young Geese "A1"	8–14 lb.	Well fattened; full breasted; flexible cartilage; free from blemishes.	
‖Young Geese "A"		Well conditioned; flexible cartilage.	
TURKEYS			
Turkeys (Young Hens) "A1"	9–18 lb.	Well fattened; full breasted; flexible cartilage; free from blemishes.	Undrawn, "clean picked" —*i.e.*, the legs, body, wings and half the neck from the base to be free from all feathers and "pin" feathers (stubs) with the exception of the shorter feathers on the end joint of the wing and back feathers covering the hips.
Turkeys (Young Cocks) "A"	12–30 lb.	Well conditioned; flexible cartilage.	

* Marketed between February 1 and June 30.
‡ De-sexed Cockerels for Christmas trade.
† Marketed between July 1 and January 31 inclusive.
§ Down-feathered only.
‖ First adult plumage.

(*d*) *Packing.*—Unless the packer is otherwise authorized by the National Mark Committee, a National Mark label may be applied only to non-returnable chip or wooden boxes of design approved by the Ministry and packed in the manner laid down in Table II. Approximate dimensions for boxes are given in Table III. When experience has been gained of the working of the scheme, package dimensions will be standardized for general observance.

(*e*) *Use of National Mark Labels and Seals.*

(i) *General.*—Authorized packers shall apply the National Mark only by means of the official labels and seals which will be issued, on payment, to authorized packers by or on behalf of the Ministry. Labels may not be obtained from any other source. They are not transferable and care must be taken by packers to prevent the labels getting into the hands of unauthorized persons. Labels of a kind approved by the Ministry shall be used for each type of container employed, and may be applied only at the premises authorized for the purpose. The quality of the contents of each package to which a label is applied must conform to the statutory definitions set out in Table I according to the grade designation appearing on the label.

The colour of the labels for the grades "A1" and "A" are blue and red, respectively.

(ii) *Completion of Labels.*—When a National Mark label is applied to a box, (1) it must bear, in the appropriate space, the registered number of the packer, in figures of not less than ½ in. in height; the packer's mark may also be added, if desired by the packer, but only in a manner approved by the Ministry; (2) the grade designation and number of birds, the total net weight, and the colour of the skin (where necessary in accordance with Table II) must be clearly marked in the space provided; (3) a code mark indicating the date of packing must also be stamped in the space provided on the label. Code-dating calendars will be supplied by the Ministry to all authorized packers.

(iii) *Use of Seals.*—A specially designed disc with lead seal attachment, bearing the imprint of the National Mark, must be affixed to each individual bird of over 1 lb. in weight packed under National Mark labels. The grade designation of the bird must be applied to the reverse of each disc by means of a rubber stamp. Birds of 1 lb. in weight and under must not be so marked. The sealing equipment will be obtainable only from the Ministry.

(*f*) *Records.*—Authorized packers will be required to keep, to the satisfaction of the Ministry, a record showing the number of National Mark labels used each day, the class and grade of poultry to which they have been applied, and the person or firm to whom the poultry has been consigned.

(*g*) *Federation of Packers.*—If and when required to do so by the Ministry, an authorized packer shall join any association or federation of packers of National Mark dressed poultry

established with the Ministry's approval for the purpose of regulating and developing the distribution of home-produced poultry packed under the National Mark.

The Ministry considers that it is necessary to look forward to the time when authorized packers will no longer be content with merely sending out standard products into the market stream and competing with each other in the process, but will feel the need of combining on co-operative lines to develop a common sales policy.

(*h*) *General.*—An authorized packer must allow his packing premises, equipment, stock and records to be inspected at any reasonable time by any officer of the Ministry of Agriculture and Fisheries authorized in that behalf, and must allow any such officer to open and inspect, on the premises either of the authorized packer or of his market-agent, any package packed by such authorized packer and bearing a National Mark label, and to remove the National Mark label from any such package, the contents of which, in his opinion, do not comply with the definition of the statutory grade designation appearing on the National Mark label.

The removal of a National Mark label will also necessitate the detachment of the National Mark seal affixed to any individual bird contained in the package and not conforming to the required conditions.

Authorized packers are expected to afford the Ministry's officers every facility and assistance necessary to ensure that the reputation of the National Mark is maintained.

Conclusion. — In recent years, home producers have given more attention to egg production than to the rearing of birds for the table, but extensive egg production is not inconsistent with the building-up of a table-poultry industry. This fact is now being recognized, and there is evidence of increasing attention being given to the production of poultry for table purposes. There is, in fact, no reason why table-poultry production, through better marketing, should not assume a position of much greater importance in this country than is the case to-day, especially as the increase in poultry production which has been stimulated by the National Mark egg scheme will bring larger supplies on to the market. In view of the technical difficulties, the present scheme may make a relatively small beginning, but there is no doubt that the standardization policy which it implies will set the trade in home-produced poultry on a sound basis to the advantage of producer, distributor and consumer, and will prepare the way for more

far-reaching reforms involving centralized selling and other aids to efficient marketing which rationalized industries can command.

TABLE III.—SUGGESTED SPECIFICATIONS FOR NON-RETURNABLE CHIP AND WOODEN BOXES TO BE USED WHEN GRADE DESIGNATION MARKS ARE APPLIED TO DRESSED POULTRY.

Internal Measurements of Boxes.

Weight per Bird.	Size of Box.			Approximate Maximum Capacity.
	Length.	Breadth.	Depth.	
CHICKEN & FOWLS:	Inches.	Inches.	Inches.	Lb.
Under 1½ lb. ..	21½	11¾	3½	20
1½–2 lb. ..	22½	14	3½	24
2 –3 ,, ..	24½	15¾	4	36
*3 –4 ,, ..	26	16½	4½	48
*4 –5 ,, ..	27½	17¼	5¼	60
*5 –6 ,, ..	29½	18	6	72
DUCKS:				
4–5 lb. ..	29	11	3½	30
5–6 ,, ..	30½	12	4	36

* Boxes for birds of this weight may also be permitted in half-sizes suitable for ½ doz. birds. In that case, the box must be of the same breadth and depth, but only half the specified length.

Note.—For poultry weighing over 6 lb., no special provision has yet been made, but the Ministry will consider the prescribing of suitable sizes in the light of experience.

[*Copies of the leaflet (Marketing Leaflet No. 17) describing the National Mark Dressed Poultry Scheme in detail may be had free on application to The Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place London, S.W.1.*]

* * * * * *

NATIONAL MARK SCHEME FOR STRAWBERRIES

THE Ministry issued in 1927 a Report on Fruit Marketing (Economic Series No. 15)*, and in 1928 a Report on the Preparation of Fruit for Market (Economic Series No. 21)*; both Reports contain detailed information of a practical kind relating to the grading and packing of home-grown strawberries.

Many growers market their strawberries graded and packed in such a manner as to command the best prices on the markets, but the majority do not. The present irregularity, both of produce and weights, causes uncertainty and dissatisfaction in the markets, and loss to all concerned. For many years, the principal organizations of retail fruiterers have, in fact, complained regarding the unsatisfactory packing and grading of English strawberries and the irregularity of the weights packed, and, in particular, have recommended that a declaration of weight should be required on every container of strawberries sent to market. More recently, the National Farmers' Union has offered to collaborate with the Ministry in preparing a scheme, under the Agricultural Produce (Grading and Marking) Act, 1928, for the grading and packing of strawberries in association with the National Mark. The present scheme is the result.

National Mark schemes are in operation for other home-grown fruits, namely, apples, pears, tomatoes and cucumbers, and the action that is now being taken with regard to strawberries is part of a programme that has already proved successful.

The competition of foreign supplies, especially of early fruit, is a consideration of some importance, and, although imports of fresh strawberries represent only about 7 per cent. of the total supplies, the introduction of a National Mark scheme which will enable home-grown strawberries to be offered under a guarantee of home origin as well as of weight and quality, will facilitate the preferential buying of home-grown fruit with corresponding benefit to the home grower.

It is recognized that it is impracticable to handle strawberries after picking for purposes of grading, and that all grading operations must be undertaken at the time of picking. In this connexion, growers who employ a proportion of casual

*Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. Price (each) 6d. net, post free, 9d.

labour for picking, and find close supervision a difficult matter in practice, will obviously not be able to market the whole of their supplies under the National Mark; such growers are recommended to employ their regular pickers on their best fruit-bearing acreage for the picking, grading and packing of supplies intended to be marketed under the National Mark. Small growers who employ but few pickers, or who depend upon family labour, do not, of course, have this difficulty.

Because of its perishability, the strawberry crop calls for more rapid marketing than any other fruit crop. It is for this reason that the non-returnable type of package has been adopted to a greater extent for strawberries than for any other home-grown fruit.

Except in Kent, where the rim-pack is still employed for the London trade, the use of the non-returnable chip basket is now almost universal.

The use of 1-lb. and 2-lb. punnets and 2-lb. and 3-lb. chips, which can be handed to the consumer, is growing in favour, and provides a means of carrying the National Mark guarantee of quality and net weight direct from the strawberry grower to the consumer.

After consultation with the various interests concerned, grade designations and definitions of quality as set out in Table I have been agreed upon for home-produced strawberries.

These designations and definitions are given statutory effect in the Agricultural Produce (Grading and Marking) (Strawberries) Regulations, 1930. Briefly, the regulations prescribe two grades: "Extra Selected" and "Selected" —based on size and colour.

Standard packs and packages, which are required to be used with these grades when the National Mark is applied, are given in Tables II and III.

Only strawberries produced in England and Wales may be packed under the National Mark.

No person may mark any article, covering or label with a statutory grade designation mark (*i.e.* the National Mark) unless authorized to do so by or under regulations made under the Act, and such authorization can be granted, revoked or suspended only by the National Mark Committee, which has been appointed by the Minister of Agriculture and Fisheries for that purpose.

Procedure and Conditions to be observed by Packers authorized to apply the National Mark.—(*a*) *Output.*—In the first year, permission to apply the Mark will be granted only to growers, or to purchasers of standing crops, of a minimum area of a quarter of an acre of cropping strawberry plants.

(*b*) *Grading.*—Authorized packers may apply the National Mark only to fruit grown in England and Wales which complies with the definitions of quality prescribed for the grade designations (*see* Table I).

(*c*) *Packing.*—The method of packing the contents of each package to which a National Mark label is applied must conform to the details specified in Table II, and the package must conform to the dimensions and capacity specified in Table III.

(*d*) *Use of National Mark Labels or Covers.*—Authorized packers may use only the official National Mark labels or covers; these will be issued, on payment, to authorized packers by the National Farmers' Union on behalf of the Ministry of Agriculture and Fisheries. Labels may not be obtained from any other source, are not transferable, and care must be taken by packers to prevent them from getting into the hands of unauthorized persons. Each package must bear the kind of label approved by the Ministry for that type of container. The quality of the contents of each package to which a label is applied must conform to the statutory definitions set out in the table according to the grade designation appearing on the label.

Labels, which take the form of covers, must be used for chip baskets, strip labels for punnets, and tack-on labels for trays. They will be coloured blue for "Extra Selected" and red for "Selected," and bear the grade designation and the net weight of the package, with a space for insertion of the salesman's name and address. Before issue, they will be over-printed with the name or mark of the authorized packer.

(*e*) *General.*—An authorized packer must allow his premises, equipment and records to be inspected at any reasonable time by any officer of the Ministry of Agriculture and Fisheries authorized in that behalf, and must allow any such officer to open and inspect, on the premises either of the authorized packer or of his market-agent, any package packed by such authorized packer and bearing a National Mark label or cover, and to remove the National Mark label or cover from any such package the contents of which do not in the opinion of such officer comply with the definition of the statutory grade designation appearing on the National Mark label or cover, or do not accord with the weight thereon declared.

when disseminated, set up fresh infections, and as the spots multiply, often becoming coalescent, large patches of the leaf are killed. Finally, the leaves become practically covered with spots and are shed prematurely.

The course of the disease, as it usually occurs on the variety Baldwin in the West of England, is as follows: infection is first noted about the middle of June, and, by the time that fruit picking is completed, the spotting of the foliage is usually general on all but the youngest leaves. Towards the end of August the infected bushes present a gaunt appearance, all the lower leaves having fallen (Fig. 3); and by mid-September the branches may be entirely bare. This relation between the dates and the progress of an attack is subject to great modification, according to variety, weather and district.

The premature defoliation is serious because it is during the period from early August onwards that the healthy black currant bush is engaged in laying down its food reserves for the ensuing year. Loss of the leaves during this period therefore weakens the plant, checks bud formation and, in the following year, results in decrease of crop (*see* Tables I and II, p. 259).

Premature defoliation of black currants may also be caused by Leaf Rust,* but this disease can easily be distinguished from Leaf Spot by the fact that the Rust fungus occurs in tawny, felted patches on the undersides of the leaves. Again, Capsid damage is at times confused with the early stages of Leaf Spot attack, but the Capsid-punctured leaves always show a distinct puckering, and they lack the angular, dark brown patches characteristic of the Leaf Spot disease.†

Varietal Susceptibility.—The disease appears to cause greatest injury to the variety Baldwin. Serious damage to French (Seabrook's Black) is rare in the West of England, although there is a record of a severe attack on this variety in Lancashire. Infection may occur on Edina, Boskoop Giant, September Black and Victoria, but no marked injury to these varieties has been recorded. The disease also occurs to a slight extent on gooseberries and, with greater intensity, on some varieties of red currant; but it is not yet known whether the strain of the fungus which attacks black currants is able to infect these other hosts.

Effect of Methods of Cultivation.—Various observations led to the conclusion that some measure of control of the trouble

* Due to *Cronartium ribicola*, a Rust fungus with two phases, one occurring on Currants and other species of *Ribes*, and the other causing the so-called "Blister Rust" of five-needled Pines.

† See this JOURNAL, Vol. XXXV, March, 1929, pp. 1133-1140.

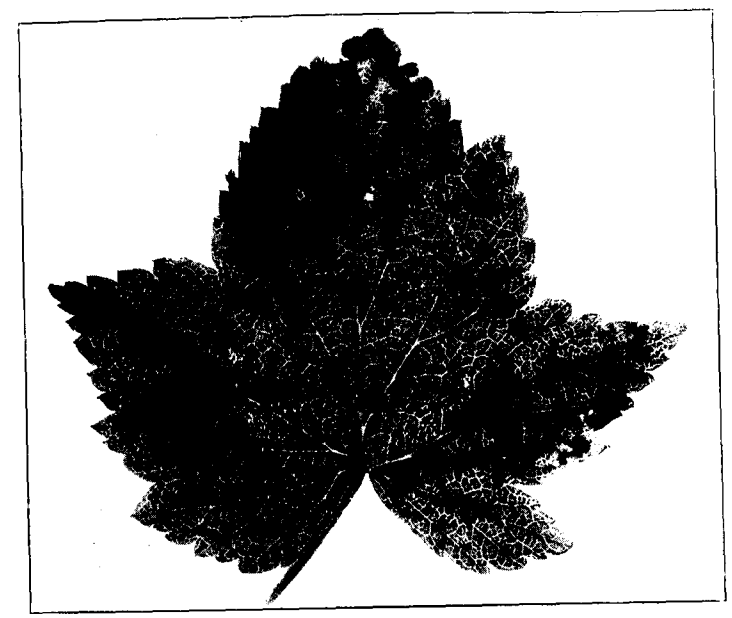

FIG. 1.—Leaf of Baldwin black currant attacked by Leaf Spot. Note how the shape of the individual spots is determined by the veins, and how large areas of the leaf are killed following the eventual coalescence of the spots.

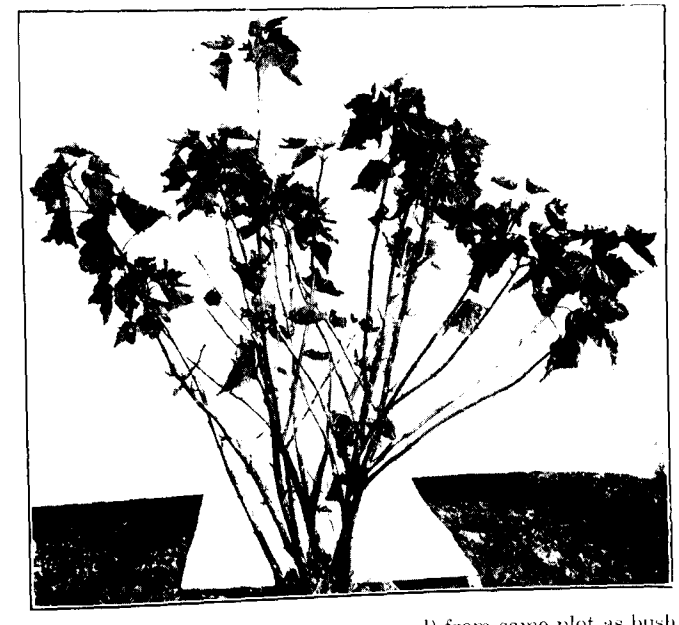

FIG. 3.—Control bush (left unsprayed) from same plot as bush shown in Fig. 2 (overleaf). Photographed August 29, 1928. The premature defoliation is due to the attack of Leaf Spot disease.

BLACK CURRANT LEAF SPOT DISEASE AND ITS CONTROL.

To face page 256.

TABLE I.—STRAWBERRIES PRODUCED IN ENGLAND AND WALES (OTHER THAN HOTHOUSE FRUIT): GRADE DESIGNATIONS AND STATUTORY DEFINITIONS.

Grade designation.	Statutory definitions of quality.*			
	Size.	Colour.	Condition.	Blemish.
(1)	(2)	(3)	(4)	(5)
Extra Selected	Each berry to weigh not less than ½ oz.	Each berry to have not less than two-thirds of surface coloured red.	All fruit when packed to be firm and have reached a stage of maturity which will normally ensure full ripeness at the time of retail sale, allowance being made for probable period of transit: fruit over-ripe at time of packing to be excluded.	All fruit to be free from blemish, mildew, dirt, sand; no berries without "plugs" and no incompletely developed fruit allowed.
Selected ..	Each berry to weigh not less than ¼ oz.	Each berry to have not less than half of surface coloured red.		

* The statutory definitions relate to the fruit at time of packing.

TABLE II.—STANDARD METHODS OF PACKING TO BE EMPLOYED WHEN GRADE DESIGNATION MARKS ARE APPLIED TO STRAWBERRIES.

Grade designation	Package.	Lining paper and packing material.	Size range of fruit.	Declaration of contents.
Extra Selected	Nos. 1 and 2 Chip Punnets. No. 2 Chip Basket (*non - returnables*) Trays (*returnables*).	For punnets and baskets, leaves and/or white lining paper may be used for packing.	Uniform.	Contents to be declared by net weight and to be in weights of 1 lb., 2 lb. 3 lb. and 4 lb. for chip punnets and chip baskets, and 12 lb., 14 lb. and 28 lb. for trays.
Selected	No. 2 Chip Punnet. Nos. 2, 3 and 4 Chip Baskets (*non-returnables*) Trays (*returnables*).	For trays, waxed or grease-proof liners must be used.	No. requirement.	

Note.—It is permissible to "face" the top berries in any package by placing them on the cheek; these berries must, however, be representative of the whole.

TABLE III.—PACKAGES TO BE EMPLOYED WHEN GRADE DESIGNATION MARKS ARE APPLIED TO STRAWBERRIES.

Non-returnable Packages.

(N.B.—All dimensions are internal.)

(Imperial Bushel = 2219·360 c. in.)

CHIP PUNNETS.

No. 1—Rectangular. Contents 75 c. in. (1 lb. of fruit.)

No. 2—Rectangular. Contents 160 c. in. (2 lb. of fruit.)

CHIP BASKETS (WITH HANDLES).

Name.	Dimensions, in inches.			Standard capacity (minimum).	Weight of fruit.
	Bottom.	Top.	Side.		
No. 2 taper ..	$7\frac{3}{4} \times 5\frac{1}{8}$	$9\frac{1}{2} \times 5\frac{3}{4}$	$3\frac{1}{4}$	150 c. in.	2 lb.
,, 2 square ..	$8\frac{3}{4} \times 5\frac{1}{2}$	$8\frac{3}{4} \times 5\frac{1}{2}$	$3\frac{1}{8}$	150 ,,	2 ,,
,, 3 taper ..	$8\frac{3}{4} \times 5\frac{3}{8}$	$10\frac{1}{2} \times 6\frac{1}{4}$	$3\frac{9}{16}$	200 ,,	3 ,,
,, 3 square ..	$9\frac{1}{2} \times 6\frac{1}{8}$	$9\frac{1}{2} \times 6\frac{1}{8}$	$3\frac{1}{2}$	200 ,,	3 ,,
,, 4 taper ..	$9\frac{3}{4} \times 6\frac{1}{8}$	$11\frac{1}{8} \times 7\frac{1}{4}$	$3\frac{3}{4}$	250 ,,	4 ,,
,, 4 square ..	$10 \times 6\frac{7}{8}$	$10 \times 6\frac{7}{8}$	$3\frac{3}{4}$	250 ,,	4 ,,

Note.—Bottom and side measurements taken from scoring; top measurements are average lengths and widths inside binder.

Returnable Trays.

No dimensions are prescribed for returnable trays.

[*Note.—Copies of the leaflet* (*Marketing Leaflet No.* 18) *describing the National Mark Strawberries Scheme in detail may be had free on application to the Secretary, Ministry of Agriculture and Fisheries,* 10 *Whitehall Place, S.W.*1.]

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BLACK CURRANT LEAF SPOT DISEASE AND ITS CONTROL

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Long Ashton Research Station, Bristol.

Description of the Disease.—Wherever soft fruit production is of importance in this country, premature defoliation of black currant bushes has frequently been reported, in particular on the Baldwin group of varieties. It is not generally realized that the commonest cause of such defoliation is the infection of the leaves by a parasitic fungus, *Pseudopeziza Ribis*, more commonly known, perhaps, in its conidial stage, as *Gloeosporium Ribis*.

Leaves at an early stage of infection show a number of dark brown spots, more or less irregularly scattered, each spot being about $\frac{1}{12}$in. across and of characteristically angular outline, delimited by the leaf veins (Fig. 1). Within the spot, the leaf tissues are occupied and killed by the fungus, and on the surface of this destroyed tissue the reproductive bodies (conidia) of the fungus are borne. These conidia are formed in enormous numbers, and in wet weather they may be seen as whitish, slimy masses on the angular spots. The conidia,

might be obtained by simple cultural treatments. A definite correlation between vigour of growth and incidence of the disease appeared to exist, and, on examination, it has been found quite definitely that heavily manured bushes of Baldwin do not suffer so badly as those but lightly manured. Although the seriousness of the disease may be apparently somewhat mitigated by heavy manuring, this treatment alone is not sufficient to avoid loss. A second line of cultural treatment carried out with the same end in view has been differential pruning. Three degrees of pruning were practised on a block of Baldwins, comprising, approximately, 3,000 bushes, which received the respective treatments in series. The treatments were: (1) cutting down to the ground, (2) normal pruning, *i.e.*, $\frac{1}{3}$-$\frac{1}{2}$ of old shoots cut to the ground, (3) no pruning. The treatments were carried out on single bushes in series, straight along the rows; thus bush 1 of the row was cut to the ground, bush 2 moderately pruned, bush 3 unpruned, bush 4 cut down, etc. In the following pruning season, bushes under treatment (3) (unpruned in the previous year) were cut to the ground; while treatment (2) bushes became treatment (3), and treatment (1) became treatment (2).

Observation of these bushes showed definitely that the degree of attack by the fungus varied inversely with the severity of pruning, so that those bushes which were cut down showed hardly any attack in the summer, while the unpruned bushes were very badly damaged; the intermediate treatment of normal pruning resulted in an intermediate degree of fungus attack. In the second year of pruning, the results of each treatment were the same as in the previous year, there being no apparent cumulative effect in reduction of the trouble. Of all pruning treatments, only those that would involve too great a sacrifice of crop would seem to be of any real value in reducing the disease, hence pruning alone is not an economic means of control.

From a general standpoint, however, the deduction from these observations is that fairly hard pruning combined with heavy manuring will lessen the probability of serious attack and, in considering the control measures mentioned below, it is as well to bear these points in mind.

Control by Spraying.—It was found that lime-sulphur spraying in the spring for the control of black currant mite had no effect on infection by the Leaf Spot fungus. Bordeaux sprays, applied in May and June, gave effective control of Leaf Spot, but spraying at this time cannot be recommended,

since the spray residue on the fruit renders it practically unsaleable. There remain to be considered the possibilities of a post-cropping spray.

In 1928, a trial of such a spray was made in the plantations of the Long Ashton Research Station on a plot of 4·3 acres (approximately 3,500 bushes) of the variety Baldwin. At the time of picking, the Leaf Spot disease had already started to develop. Most of the older leaves showed spots, but no defoliation had set in and the young leaves were generally clean. On July 20, *i.e.* immediately after picking, the whole plot was sprayed, with the exception of 10 rows (345 bushes) left as a control. Approximately half the plot was sprayed with a 4-4-50 Bordeaux mixture; the remainder of the sprayed bushes received a 2-4-50 mixture. In this second group an attempt was made, on a block of 340 bushes, to spray the leaves on their undersides only.

Within a month, the efficacy of the treatments was apparent. By August 29, when the photographs (Figs. 2 and 3) were taken, the lower halves of the bushes in the control block were destitute of leaves, while such leaves as remained had almost entirely withered, following the attacks of the Leaf Spot fungus. The sprayed bushes, on the other hand, showed no defoliation whatever, and the existing infection on the older leaves had apparently made no further progress. Figures 2 and 3 show a sprayed and a control bush respectively. The contrast shown by these photographs became even more striking in September, when the unsprayed bushes were absolutely bare, whereas the treated rows retained their leaves until the normal time of shedding. No variations due to the different methods and strengths of spraying could be determined. Trials of the efficacy of a post-cropping lime-sulphur spray have not yet been made.

In early November, buds were taken from sprayed and from unsprayed bushes; the differences in size were noted, and are set out in Table I below.

The buds from the sprayed bushes were thus found to be 6·2 per cent. longer, 14·3 per cent. broader and 15·3 per cent. heavier than those from the unsprayed.

In the following summer, the bushes sprayed in 1928 showed denser foliage and more vigorous growth than those in the control block. The crop was picked on July 23-26, 1929, and the weight from the 10 rows, left unsprayed in 1928, was compared with that from the three comparable blocks adjoining. On all the bushes the crop was light, due to

unfavourable weather at the time of flowering. The results obtained are given in Table II.

TABLE I.

Comparison of Size of Buds from Sprayed and from Unsprayed Bushes.

	From unsprayed bushes			From sprayed bushes		
	Minimum	Maximum	Average	Minimum	Maximum	Average
Length of 20 buds taken at random (cm.) ..	0·63	0·97	0·80	0·69	1·04	0·85
Breadth of 20 buds taken at random (cm.) ..	0·20	0·33	0·28	0·27	0·42	0·32
Weight of 1,000 buds taken at random (in grammes)	Total 36·37			Total 41·93		

TABLE II.

Comparison of Crop Weights from Sprayed and from Unsprayed Bushes.

			lb.	oz.
Total weight from rows	3-12 (sprayed 1928)	..	338	10
,, ,,	13-22 (,, ,,)	..	322	10
,, ,,	23-32 (,, ,,)	..	330	7
,, ,,	33-42 (not sprayed)	..	261	7

The average weight of fruit from an unsprayed row was 26 lb. 2 oz., and that from a sprayed row 33 lb. 1 oz.—an increase of 26 per cent. as a result of a single spraying.

After the picking of the 1929 crop, one block of black currants was sprayed with Bordeaux mixture on August 9, with results that, up to the time of writing, have fully confirmed those obtained in 1928. The main block of Baldwins, however, was not sprayed until August 20, on which date, in addition, a small block was dusted with a copper-lime preparation. By the time that this application was made, the disease had made very considerable progress and some defoliation had set in. Nevertheless, the Bordeaux spraying arrested the attack; the dusting, on the other hand, had only a slightly favourable effect. The results so far obtained in 1929 confirm the value of a Bordeaux spray in the control of black currant Leaf Spot and emphasize the importance of early application. With this Leaf Spot, as with many other fungus diseases, the maximum effect of spraying is to be obtained by carrying out the operation at the earliest time practicable—in the present instance, immediately after picking.

FIG. 2. Black Currant bush sprayed with Bordeaux mixture on July 20, 1928. Photographed August 29, 1928.

SUGAR BEET INVESTIGATIONS, 1929

THE series of sugar beet demonstrations, begun in 1927, and carried on in 1928, were continued in 1929 on an "investigational" rather than a "demonstrational" basis. The investigations in 1929, as, also, the demonstrations in previous years, were made possible by the aid of a grant from the beet sugar factories. Results of the earlier series were published,* and it is thought that a note on the latest series will be of interest to all farmers who are engaged in growing the crop.

The object of the investigations in 1929 was to deal more specifically than in previous years with the problems of plant population, manuring in relation to the requirements of the district, and with varieties.

The number of district areas and also the number of investigations carried out in any one district were reduced, and more detailed and accurate trials were attempted.

Weather Conditions.—The severe winter frosts enabled a fine tilth and good seed bed to be obtained readily in most cases. Where rain fell between drilling and singling time, germination was regular, but in some districts the drought delayed germination and entailed a second seeding or the ploughing out of an unsatisfactory plant. The subsequent great drought did not, except on the lighter soils, prevent the realization of a heavier yield of beet per acre, with a consistently higher sugar percentage, than in the previous two years. The fine weather during the earlier period of lifting enabled the bulk of the crop to be harvested under good conditions, thus reducing the cost of operations and of dirt tare. As a rule, the response to artificial manures was satisfactory despite the drought.

General Results.—In general, the results support the conclusions arrived at in the previous years' reports, but, without questioning the reasonable reliability of these conclusions, it must be pointed out that no significance can be attached to the statistical data, and, therefore, no comprehensive analysis of the results can be made. The returns, if looked upon as empirical, and relating only to the district or centre from which the results were obtained, provide, in conjunction with the investigator's interpretation, information of local value. Nevertheless, it is impossible to assess variations in yield

* *Sugar Beet Demonstrations*: Miscellaneous Publications, No. 63, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1. Price 2d. net, post free.
"Sugar Beet Demonstrations, 1928": this JOURNAL, XXXVI (April, 1929), pp. 11-24.

quantitatively, with any degree of reliability, under a scheme which lacks the precision of a scientific experiment or a sufficient number of centres to mitigate or counteract the inconsistent factors which arise in attempting to make comparisons. It is only necessary to mention the possible influence on the result of such factors as variety, dates of sowing and singling, differences in plant per acre, and previous manuring and cropping to indicate the limitation of a direct comparison of crops grown at different centres, when, for example, the object is the solution of a direct manurial problem.

If the average crop of beet is to be raised from eight tons to ten tons, representing a 25 per cent. increase, these results individually do not appear to indicate the direction in which the increase may be obtained. In the past year the value of a good tilth produced by natural conditions, associated with the climatic influences which provided regular germination, good growth, a higher sugar content and a clean and dry lifting time, tends to indicate that these factors, together with what is known as "fertility," or land in good heart, are the dominant factors in beet cultivation as with all other crops.

Inter-Row Widths and Spacing.—It has seemed to all observers who have conducted trials during the past three years that there is a definite correlation between yield of beet and the number of plants per acre. Consequently trials at varying row widths and different intervals of spacing were carried out with the object of arriving at the optimum number of beet plants per acre.

When they are considered separately, the district results indicate as in previous years that the narrower rows provide the higher yields, but the variation in row widths and singling distances prevents even an arithmetical mean or average being taken from the collective returns. The consensus of opinion favours the narrower inter-row width of not more than 20 in., with singling to a distance of 10 in. The results, however, are not sufficiently uniform to provide conclusive evidence on the point. Factors already mentioned in connexion with these investigations, of which strain is possibly very important, preclude direct comparisons.

An important consideration in relation to row-width trials is introduced in the Essex investigations, where operation costs have been kept. The cost of manual and horse labour from drilling up to, and including lifting, with 17-in., 21-in. and 24-in. work is shown to be £3 4s. 2d., £1 12s. 8d., and

15s. 9d. per acre respectively more than the cost on 28-in. work.

In Norfolk, a carefully executed investigation was conducted with the object of arriving at the influence of inter-row distance. In order to eliminate the effect of plant population per acre, an attempt was made, by controlling the rate of seeding and by singling to a measured distance, to leave the same number of plants per unit area, namely, 30,000 plants per acre. The result emphasizes the extreme difficulty of eliminating a normally variable factor under field conditions. In only six cases out of thirty-four were the number of beet lifted within 500 of the anticipated 30,000 plants to the acre.

Nitrogenous Manures.—About three cwt. per acre may be regarded as the optimum quantitative dressing. Where no beneficial results were obtained the character of the soil, shortage of moisture or of organic matter from dressings of dung, suggested a sufficient reason for the negative result.

At six centres the dressing consisted of nitrate of soda, at four centres of sulphate of ammonia, and at two centres of a mixture of equal parts of each of these manures.

The general findings of previous years, that the best time of application was at seed time, was not borne out at all centres in 1929, but this effect may be attributable to the unusual climatic conditions and the fact that in the absence of sufficient moisture the early applications were not fully used.

In three districts investigations were carried out with different types of nitrogenous manures. The manures tested were nitrate of soda, sulphate of ammonia, nitro-chalk and calcium cyanamide. The highest increase in yield was given by nitrate of soda in one district, by nitro-chalk in the second and calcium cyanamide in the third. Nitrate of soda appeared to produce higher yields than sulphate of ammonia.

Mineral Manures.—These investigations were confined to fen soils, and confirm the findings of previous demonstrations, namely, that dressings of superphosphate up to four cwt. per acre give the greatest increase in weight.

On black fen soils which are naturally fertile complete dressings of artificials show little response. Where comparisons were made between different forms of phosphatic manures, superphosphate gave better results than either slag or steamed bone flour.

Varieties.—The trials of varieties are inconclusive.

It is not thought necessary to include in this note the reports of the local results, since these must be regarded as of local

significance only, but those who require detailed information of these results should apply either to the Ministry or to the Agricultural Organizer of the County in which the work was done. The counties which co-operated in the investigations were Cambridge, Essex, Kesteven, Lindsey (Lincs.), Norfolk, Nottingham, Shropshire, East Suffolk and Yorkshire.

Certain investigations were also carried out in Huntingdonshire, through the School of Agriculture, Cambridge.

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THE USE OF POTATOES IN PIG FEEDING

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THE potato is the most important crop in the Holland Division of Lincolnshire, and large supplies of chats and damaged tubers are available each season for stock feeding. Generally speaking, most of these tubers are used for this purpose, being fed in a raw state to cattle and occasionally to horses, and either cooked or raw to pigs. No very precise knowledge of the food value of potatoes exists. The potatoes are used in a haphazard and unsystematic way, with the result that a valuable food is not often utilized to the best advantage.

Many farmers in the area keep pigs chiefly to consume non-marketable potatoes, buying in strong stores in the autumn for the purpose. Frequently little or no meal is given, the potatoes in such cases generally being fed raw. In other cases, meals are used without consideration of the balance of the ration : *e.g.*, barley meal only may be used with the potatoes.

What Quantity of Potatoes can be consumed by the Pig in a Balanced Ration?—If the best results are to be obtained from potatoes as a pig food, they must be used as a definite part of a balanced ration. It is generally recommended that they should be used as a substitute for barley and maize meals, or other fattening meals, at the rate of 4 lb. of potatoes for every lb. of meal replaced. In order to ascertain what proportion of the fattening meals could be so replaced, the following experiment was undertaken.

Sixteen pigs were drawn from two litters farrowed on July 14, 1927. The pigs were cross-breds, the progeny of a Large White boar and Large Black sow. They were allowed to run rough until the commencement of the experiment on December 15, 1927, being at that time 22 weeks old. This was because the type of pig in favour in the local markets is large and some-

what fat, and the local custom is to commence fattening at about 20 to 22 weeks old. The pigs were divided as evenly as possible into four pens. Pen 1 received a ration consisting solely of meals, and acted as control.

The mixture fed to this pen—as to all the pens—was adjusted as required according to the increasing age of the pigs. Steamed potatoes were introduced into the ration fed to Pens 2, 3 and 4, in replacement of the fattening meals, at the rate of 4 lb. of potatoes to every 1 lb. of barley and maize meal. Maize meal being at the time comparatively cheap, a limited quantity was used in the ration in place of barley meal.

The following are details of the rations :—

PEN 1. At commencement of experiment—December 15, 1927.

Mixture 1	Fish meal	10 lb.
	Pollards	25 ,,
	Barley meal	43 ,,
	Maize meal	22 ,,
Mixture 2	Changed on January 16, 1928, to :—	
	Fish meal	5 lb.
	Pollards	25 ,,
	Barley meal	47 ,,
	Maize meal	23 ,,
Mixture 3	Changed finally on March 1, 1928, to :—	
	Barley meal	43 lb.
	Pollards	35 ,,
	Maize meal	22 ,,

PEN 2. One-third of the total barley and maize meal was replaced by potatoes, altered as required on January 16 and March 1.

PEN 3. Two-thirds of the total barley and maize meal replaced by potatoes, and altered as required on January 16 and March 1.

PEN 4. All the barley and maize meals replaced by potatoes.

The rations fed to Pen 4 were in the following proportions :—

December 15		*January* 16		March 1	
Fish meal	10 lb.	Fish meal	5 lb.	Fish meal	Nil.
Pollards	25 ,,	Pollards	25 ,,	Pollards	35 lb.
Potatoes	260 ,,	Potatoes	280 ,,	Potatoes	260 ,,

Instructions for feeding were that each pen should be given as much food daily as could be cleared up without waste. The steamed potatoes and the meal were mixed before feeding. The pigs did well throughout the experiment and no trouble was experienced. Pen 1 obviously made the quickest progress, and was ahead of the others, finishing well and full of bloom. The pigs to which potatoes were fed had not the same well-finished appearance, Pen 4 in particular being somewhat lacking in bloom. Had the pigs been sold in the local auction market, the pigs of Pen 1 would no doubt have made more per score (or stone) than the others. It was desired, however, to obtain complete reports on the pigs, and Messrs. Marsh & Baxter,

when approached, very kindly consented to supply complete details.

The pigs were railed to Messrs. Marsh & Baxter on March 26, 1928. The experiment lasted 102 days, the pigs being 36 weeks old at the finish. The following table shows the essential weights figures :—

	Initial live weight	*Fasted live weight*	*Dead weight*	*Killing loss per cent.*	*Live weight gain*	*Daily gain in live weight*
Pen 1 .. Average per pig	85 lb.	262¼ lb.	210½ lb.	19·6	177½ lb.	1·740 lb.
Pen 2 .. ,,	85¼ ,,	250¼ ,,	200½ ,,	19·8	165 ,,	1·618 ,,
Pen 3 .. ,,	84¼ ,,	237 ,,	188½ ,,	20·4	152¾ ,,	1·498 ,,
Pen 4 .. ,,	87½ ,,	245½ ,,	195¾ ,,	20·2	158 ,,	1·549 ,,

The table shows that Pen 1 made the best progress, and that generally speaking the rate of progress decreased with increasing quantities of potatoes. Pen 3 made a comparatively low gain in live weight, and this cannot be satisfactorily explained. Apart from this pen, the live weight increases were good.

It was expected that the increasing bulk in the ration would tend to slow up the rate of live weight increase, and it was rather anticipated that, with the heavy use of potatoes, the daily live weight gain might fall below an economic figure. The differences, however, between the daily live weight increases are much less than was expected. Omitting Pen 3, which is abnormal, the difference in live weight gain between Pen 1, receiving the most concentrated ration, and Pen 4, receiving the bulkiest ration, was 0.187 lb. per day in favour of Pen 1. It would appear, therefore, that the pig can make fair use of a bulky ration provided the bulk represents nothing more difficult to deal with than water, and that the food is otherwise suited to the animal. It is of interest to note that the four pigs in Pen 4 were consuming 112 lb. of potatoes and 12 lb. of meal per day on the average between January 16 and March 1.

Costs of Production.—A more important aspect of the experiment is that dealing with the cost of production. The following figures are based on the prices actually paid for the various meals during the course of the experiment. These prices were as follows :—

Fish meal : £22 per ton.	Pollards : £9 per ton.
Barley meal : £12 per ton.	Maize meal : £10 per ton.
Chats and waste potatoes : valued at £1 per ton.	

The value of £1 placed on potatoes is purely nominal. It may well be argued that in a district with such a large production of potatoes, chats and damaged tubers are a by-product for which there is no market, and it is quite certain

that there is very little actual market for them. The figure taken represents that usually paid when potatoes are purchased locally for pig-feeding purposes.

Cost of Cooking Potatoes.—In the figures of costs per lb. live weight increase given later, no allowance is made for cooking the potatoes.

It is argued by some farmers that the cost of preparing and cooking potatoes makes them uneconomic as a food for pigs. In consequence of a good deal of discussion and criticism on this point, and its obvious bearing on the final figures given in this report, an investigation was made, in the spring of 1929, into the cost of cooking potatoes.

The following are the figures arrived at :—

	s.	d.
Coal required to steam one ton of potatoes—1¼ cwt. at 1s. 8d. per cwt.	2	1
Labour—ditto, *i.e.*, firing, filling boiler, filling steamer, attention to and emptying—2½ hours at 8½d. per hour	1	9¼
If the potatoes have to be washed, dressed, etc., 6½ hours instead of 2½ hours.	3	10¼

Total cost 6s. 8¼d. per ton.

Four tons of potatoes are equal to approximately one ton of barley meal, and the cost of preparing four tons of potatoes would vary between 15s. 5d. and 26s. 9d. In this part of the country it is exceptional to wash potatoes.

NOTE.—The above costs were worked out on the preparation of only one steamer full of potatoes, the steamer holding 4 cwt. Had the cooking been continued for several steamer lots, as would normally be the case, at least on an average farm, the cost per ton would be greatly reduced, as once steam pressure is obtained, very little coal suffices to maintain it. Further, the herdsman is available for other duties whilst the potatoes are cooking.

Details of Costs of Production.—The manurial value of the feeding stuffs used was allowed for as follows, the figures being taken from the issue of this JOURNAL for March, 1928: Fish meal, £3 10s. per ton; Pollards, 18s. per ton; Barley meal, 10s. per ton; Maize meal, 11s. per ton.

The following table shows the essential figures :—

	Net cost of meal and potatoes	*Total food consumed per pig, per day*	*Total food consumed per lb. live weight gain*	*Food consumed per lb. live weight gain if 4 lb. potatoes equal 1 lb. barley meal*	*Total cost of food per lb. live weight gain*
Pen 1 ..	£17 18 1¾	9·41 lb.	5·41 lb.	5·41 lb.	6·06d.
Pen 2 ..	14 5 10	14·777 lb.	9·12 lb.	5·42 lb.	5·577d.
Pen 3 ..	10 10 11¼	18·343 lb.	11·394 lb.	5·019 lb.	4·51d.
Pen 4 ..	9 14 3	27·515 lb.	20·765 lb.	5·883 lb.	3·69d.

The figures show a very marked reduction in the cost of production per lb. live weight gain as the quantity of potatoes is increased. At the time the pigs were sold, bacon prices were very low, and pig feeding generally was not leaving much profit. The following table shows, however, that at a time when pig feeding was leaving practically no profits, reasonably good profits were obtained when potatoes were used in the ration.

	Actual return less carriage		*Cost of feeding per lb. live weight increase*		*Cost of food per pen, plus initial cost of pigs at £3 each*	*Difference between cols. 1 and 5, representing balance left*
	Total per pen	*Per lb. live weight*	*Meal only*	*Meal and potatoes*		
	£ s. d.	d.	d.	d.	£ s. d.	£ s. d.
Pen 1	31 10 6	7·22	6·06	—	29 18 1¾	1 12 4¼
Pen 2	30 10 7	7·31	5·05	5·57	26 5 10	4 4 9
Pen 3	29 0 5	7·33	3·60	4·51	22 10 11¼	6 9 5¾
Pen 4	30 0 9	7·33	1·99	3·69	21 14 3	8 6 6

The balance shown in the last column would be the sum remaining to pay for labour, and other overhead charges, and also provide for profit.

It will be noted that the consumption of food per lb. live weight gain is high. This is not capable of entirely satisfactory explanation. The pigs were kept to a greater age than is usual in most districts, although not unusual for South Lincolnshire markets. A number of the pigs were above the size required by the Midland curers, and were paid for at a lower price per score, otherwise the returns would have been slightly greater and the consumption of food per lb. live weight gain probably less.

There may also have been a certain amount of waste in feeding, as no control was exercised on the amount of food supplied, the instructions being to give the pigs as much as they would consume, without waste. Frequently, however, the herdsman had to be checked for having given too much food. There are also other reasons which need not be entered into.

Report on the Carcasses.—Messrs. Marsh & Baxter very kindly offered to give full reports on the carcasses, and most of the following information is extracted from their reports.

The live pigs were described as a fairly uniform lot of good type. The carcasses were of good length and of good thickness in the belly, and not too fat. No seedy cut was found. Five of the pigs were overweight, *i.e.*, over 210 lb. (one in each of Pens 1, 3 and 4 and two in Pen 2).

Some hours after slaughter the carcasses were examined by an experienced foreman, and the fats were graded as follows :—

Pen 1 ..	Softest	Pen 3 ..	Soft
Pen 2 ..	Firmest	Pen 4 ..	Firm

It is pointed out that "experience on the laboratory side has tended to show that opinions on the texture of the fat, based on the feel of the carcass a few hours after killing, are not to be relied upon—the decision is sometimes reversed when the cured hams and bacon are examined."

After curing, the bacon was examined by an expert, two sides from each pen being selected at random, and were graded as follows :—

Pen 1 ..	Soft and oily	Pen 3 ..	Between 1 and 2.
Pen 2 ..	A shade firmer than No. 1.	Pen 4 ..	Firm and good.

Chemical tests of the fats were also made, and the report states that "owing to the variation in the weights of the carcasses in each pen, it is only possible to generalize, but the figures of these tests indicate that there is a steady increase of firmness from Pen 1 to Pen 4. Pen 3, therefore, becomes moderately firm and Pen 4 definitely so."

Referring to the lack of agreement between the expert's judging of the bacon and the chemical tests, Messrs. Marsh & Baxter point out that the relative positions of Pens 2 and 3 as judged by the expert are the reverse of what would be expected from the chemical tests, but the expert's observations were made on two sides only, whereas the chemical tests of the fat represent the true average of all the pigs in each pen, excluding the two under 160 lb., one in Pen 3, and one in Pen 4, but including the overweight pigs.

Summary.—(1) Cooked potatoes can be fed to pigs in substitution for barley and maize meal.

(2) Potatoes will produce a carcass of as good and probably better quality than meals.

(3) Potatoes, when available on the farm, offer a means of reducing the costs of production.

(4) Potatoes can frequently be purchased at a price below the equivalent cost of barley meal.

(5) Although in the above experiment the consumption of meal per lb. liveweight gain is high, the difference in the costs of production leaves no room for doubt as to the suitability and value of potatoes for pig feeding.

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DAMAGE TO MANGOLDS BY RODENTS

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SEVERE damage to growing mangold crops was reported, during June and July, 1929, by many farmers in North Wales, consequent reductions in final yield being estimated by them at from two to five tons per acre. As most dairy farmers in this area depend upon mangolds to furnish succulent food for their cattle during the late winter months, and as they usually allot to the crop only the minimum acreage likely to produce their requirements, it will be understood that serious damage may occasion considerable loss. Samples of the damaged plants were received from the Bangor, Caernarvon, Llandudno and Pwllheli districts, and, as the damage seemed fairly widespread, an investigation into the cause was undertaken.

The damaged plants resembled that shown in Fig. 1c, the tops being completely severed from the roots. The top portion, consisting of the leaves, was invariable undamaged, while the small portion of the root was slightly tapered or entirely scooped out. The root portion had been cut at ground level and had a flattened-out surface above. Cut surfaces of both the top and bottom portions showed blackening from the oxidation of the plant juices.

There are, of course, several forms of damage to mangolds which may result in the ultimate severance of the top from the root; and the farmers concerned offered various suggestions as to the cause of the trouble. Some attributed it to blackbirds and pheasants, but, while these birds were present in certain of the fields affected, there was ample evidence to exonerate them. Wireworms and cutworms, which are occasional pests of mangolds, were also suspected, but these were either absent or not present in sufficient numbers to account for this particular damage. Farmers whose mangolds had suffered in previous years from attacks by Springtails (Collembola) were inclined to blame this pest; and some colour was given to this suggestion by the presence, on and around some of the attacked plants, of numbers of the small black springtail (*Bourletiella hortensis*).

It was evident, however, that here these insects were but a secondary factor, and were merely intensifying damage previously sustained. Although on some of the farms a few

plants revealed the typical springtail strangle, the main damage inflicted on the affected crops was quite different. Ultimately, the investigation proved it to be due to rodents, chiefly hares, while, at a few centres, where hares are rarely seen, rabbits were found to be the culprits.

Close examination of the root portions of the damaged plants showed the damage to be a *cut* and not the *strangle* resulting from the gradual gnawing of springtails, although the sharp edges of the cut surface had been rounded off by them in some cases. In the case of springtail attacks, the damaged surface, which is usually slightly above ground level, tapers gradually and there are no jagged edges. In this case, the cut surface of the root portion was quite flat and generally flush with the ground, while the cut surface of freshly damaged roots invariably had jagged edges. Moreover, the gradual feeding of springtails allows time for the oxidation of the plant juices, so that all specimens show the damaged surface blackened. The present attack was, however, much more rapid, and it was always possible, in the early morning, to find some roots with freshly cut surfaces still white.

Observations at all centres revealed a few specimens, like those shown in Figs. 1*a* and 1*b*, with teeth marks present, proving damage by a rodent, although on most of the damaged plants, like that shown in Fig. 1*c*, the teeth marks could not be detected. Still, while there was ample evidence to prove that hares were the cause of the trouble, one farmer was sceptical, but undertook to watch his root field through a telescope at 5.30 a.m. At this hour, he saw hares feeding among the mangolds, and, having visually marked some of the plants, he later found them freshly destroyed. Farmers whose crops had suffered had previously experienced slight damage by hares, usually to the mangold leaves, but none could recall any year when the attack had been so serious. There is little doubt that it was due to the very dry June in the Bangor district, the resulting abnormal scarcity of succulent food causing the hares to turn to the young, sappy mangold roots. This ability of the hare to form a local habit quickly to meet a particular circumstance shows that it may occasionally become a very serious pest.

Some idea of the extent of the damage can be gleaned from Figs. 2 and 3, views taken in a field at Penrhyn Home Farm, the manager of which, Mr. W. J. Gough, was the first to report damage on June 24. The field is level and the soil a heavy clay. About 5 acres of mangolds (Yellow Globe) were flanked on the

west by swedes and a wood beyond, and on the east by potatoes with oats beyond. The plants, the singling of which had been completed on June 8, and which received a dressing of nitrate of soda on June 25, averaged ¾ in. diameter. The attack, although more severe in patches, was distributed throughout the field. Fig. 2 shows, in the foreground, gaps due to the feeding of the hares, and in the close view (Fig. 3) the undamaged tops can be seen lying beside the roots from which they have been severed. The hares were in the habit of visiting this field every night, and their track from the gate alongside the wood to the potatoes, which provided cover on the opposite side of the mangolds, can be seen in the centre of Fig. 2.

Control Experiments.—It was decided to experiment with control measures, and the writer is indebted to Mr. Gough for facilities for carrying out the preliminary trials at the Penrhyn Home Farm. Shooting pigeons over the ground in the evening had a negligible frightening effect upon the hares, which were present in the field early on the following morning. A proprietary specific for " bolting " rabbits was tried for repellent effect, being first applied to binder twine tied from stake to stake around the field, and, subsequently, when emulsified with soft soap in the form of a solution, being sprayed on and around the plants. Both methods, however, failed to ward off the attacks of hares. Fencing off the crop with wire-netting proved effective at this centre, but it will be realized that, on most farms, it would be impracticable to do this each year.

Naphthalene.—It was, therefore, decided to try the effect of naphthalene in the field attacked (Figs. 2 and 3). On June 28, three rows of mangolds, each containing 300 plants, were treated with whizzed naphthalene,* applied by hand as a light dusting near the plants, and used at the rate of 1¼ lb. of naphthalene per 100 yards run of row (approximately ¾ cwt. per acre). These rows were separated by groups of ten untreated rows, and three untreated rows were marked as controls. Examination on the following day (June 29) showed that none of the treated rows had been damaged. Counts on the untreated control rows showed that 10, 0 and 12 per cent., respectively, had been destroyed. It was evident that the hares disliked the presence of the naphthalene, although the figures given hardly indicate the full effect, as the hares, on finding an obnoxious smell in the treated area, moved their centre of feeding to another part of the field, where as many as 26 per

* Whizzed naphthalene was purchased at 14s. per cwt.

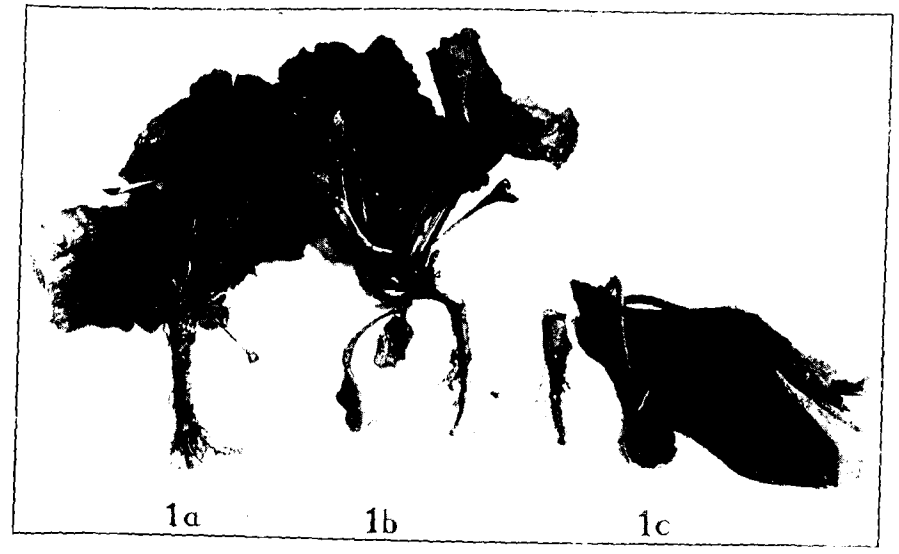

FIG. 1. Young mangold plants damaged by hares. (1a) Initial marking. (1b) Partial destruction. (1c) Complete severance. This last was the stage commonly found in the field.

FIG. 3. - A close-up view of destroyed mangolds in the field.

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cent. of the plants were destroyed in a night. The ultimate effect of naphthalene at this centre could not be obtained, as the whole crop was later fenced off with wire netting, after which no further trouble was experienced.

It was arranged, however, to try the effect of naphthalene at three other affected centres.

(1) (Parciau Rhos, Portdinorwic, near Caernarvon.) At this centre, the root field attacked was divided into 1½ acres of mangolds, ½ acre of sugar beet and 2 acres of oats. The mangolds (Yellow Globe) had been singled during the second week in June, and the average diameter of the roots was ¾ in. The attack, first noticed on June 28, was reported on July 1, on which day naphthalene was applied as a dusting near the mangold roots. Three rows, the full length of the field, and separated from each other by six untreated rows, were thus treated with whizzed naphthalene, three of the intervening untreated rows being marked as controls. Examination on the following day showed that not a single plant in the treated rows had been touched, but in the untreated rows plants were destroyed, none being touched in places which the hares had not visited, but up to 28 per cent. destroyed in what had obviously been their feeding centre during the night. It should be noted that two of the treated rows passed through this feeding centre. Examination on July 5 (five days after treatment) showed that, in certain areas, from 1 to 6 per cent. of the treated plants had been destroyed, while on the untreated rows the destruction ranged from 20 to 45 per cent.

As a result of this trial, the farmer was anxious to treat the entire mangold crop, and it was decided to do this by adding naphthalene to nitrate of soda, which had not then been applied as the manurial top dressing. It was found that 14 lb. of whizzed naphthalene gave 1 cwt. of nitrate of soda a distinctly strong smell, and on July 6 the entire crop was dressed with this mixture at the rate of 1 cwt. per 1½ acres of mangolds, a small quantity being applied near the roots in the manner occasionally adopted for applying nitrate of soda as a top dressing. It was found on the following day that this treatment had been very effective, only a few plants near the headlands having been damaged during the night. Examination a week later (July 13) showed that the attack had completely stopped, the residue of the mixture present near the roots still possessing a marked smell of naphthalene. Damage was still continuing on untreated mangold crops in the neighbourhood.

(2) (Penybryn, Bangor.) At this centre, about 3 acres of Yellow Globe mangolds, flanked on either side by swedes, were growing on a north-eastern slope, the plants having been singled during the second week in June. Damage was reported on July 4, when control experiments with whizzed naphthalene were instituted on the lines of those at Centre 1. Examination on the following day showed no damaged plants in the treated rows, whereas from 9 to 26 per cent. had been destroyed in places on the controls which the hares had visited. Examined again on July 8, the treated mangolds were still untouched, but the damage in the control rows had increased to 37 per cent. On this date, one acre was top-dressed with nitrate of soda alone, and the remaining two acres with a dressing of the naphthalene and nitrate of soda mixture tried at Centre 1. Periodic examination until July 21, by which date the plants were growing beyond the stage of serious attack, showed that the latter treatment had had a marked repellent effect, only an occasional destroyed plant being found. The hares, however, continued to visit the area which had received only nitrate of soda, and freshly destroyed plants were found here at each visit, showing that the manure alone had no deterrent effect. A fortnight (July 21) after application, there was still an appreciable smell near the plants which had received naphthalene. The farmer reported subsequently that a few destroyed mangolds were found throughout the field, but stated that the damage was negligible compared with the initial attack.

From this experience, it seems advisable to treat the entire crop in order to deter hares from damaging it. The farmer at this centre intends, if the season is dry this year, to include naphthalene in the nitrate of soda dressing, which will be applied soon after thinning; and to supplement this, when the effect of the first naphthalene has worn off, by a dressing of naphthalene alone, applied as in these experiments.

At this centre, a small portion of a fresh sample of the whizzed naphthalene used was found to scorch the mangold leaves slightly. The scorching was no greater than that often experienced after dressing with nitrate of soda, and was the only instance of damage resulting from the use of naphthalene, despite its application to very young seedlings.

(3) (Glasfryn, Pwllheli.) Damage at this centre was reported when the farm was visited, the farmer reporting that hares were practically unknown there. Damage was more severe in a hollow in the centre of the field, but, at the time of the in-

FIG. 2.—Field of mangolds, showing gaps caused by the feeding of hares. The white arrow points to the track of hares from the wood.

spection (4.30 p.m.), there were no freshly attacked plants in this portion. Examination of a row of mangolds next the potato crop in the same field, however, revealed several plants that had been destroyed during the day. The presence of teeth marks on some of them, and the finding of fresh rabbit dung nearby, made it evident that rabbits were the culprits in this instance; and these rodents were common in the potato crop near the freshly destroyed plants. About 20 sq. yds. of mangolds were treated with naphthalene, as at the other centres, all destroyed plants being removed before the application. The farmer reported that, for several days following, none of the treated plants was touched. When visited on July 18 (15 days after treatment) the presence of naphthalene could still be clearly detected, and although a few of the treated plants (average count of 4 per cent.) had been destroyed, the main attack had been transferred to other portions of the crop.

Naphthalene Experiments on Golf Greens.—Incidentally, it may be recorded that naphthalene was also tried on golf greens to prevent damage by rabbits making "scratching holes." After these holes were repaired, it was invariably found on the following morning that the soil and turf used to fill them had also been scratched away, the supposition being that the rabbits were attracted to the holes by the excreta found around them. Naphthalene was applied as a dusting over the repaired holes, and, in spite of heavy rain after the application, they remained undisturbed for over a week. On one green, where a section was lightly dusted with naphthalene, no holes were made up to eight days after the application. The trouble ceased later in the season, and it was impossible to carry the trials further.

Paraffin.—At Centres 1 and 2, the effect of sawdust soaked in paraffin ($\frac{1}{4}$ pt. paraffin to 5 lb. sawdust) was also tried as a repellent, two rows of mangolds at Centre 1, separated by six untreated rows, having a small handful of the preparation placed near each root. Examination on the following day showed that in one treated row (435 plants) 3 had been destroyed, and in the other (442 plants) none were damaged. The two untreated rows, marked as controls, showed 26 plants destroyed out of 441, and 18 destroyed out of 438, respectively, the destroyed plants being all in the same local region. Similar results were obtained at Centre 2. In both cases, however, the general application of naphthalene prevented further experiments with paraffin. The repellent effect of the paraffin did not appear to be so lasting as that of naphthalene, but where the use

of the latter is impracticable, an application of paraffin-sawdust might be tried as an alternative.

Pine Tar Oil.—This was also tried, applied to sawdust like the paraffin, but was not found to be successful as a repellent.

Discussion of Data.—In the above experiments, counts were relied upon to ascertain the relative effect of each treatment. It soon became obvious, however, that as the hares tended to avoid the treated areas and establish fresh feeding centres, counts taken over the *whole treated area*, considered as the experimental plot, did not fairly represent the effect of the treatments. Thus, at Centre 1, a treated row showed no plants destroyed out of a total of 839, while in the corresponding control row, 39 plants were destroyed out of 842, giving a percentage destroyed of only 4·6. Similarly, another treated and control row showed percentages destroyed of 0 and 3·6 respectively; so that the relative effect of the naphthalene appears small. It became necessary, therefore, to consider *the area visited by the hares after a treatment as the experimental portion*. Hence, the method adopted for obtaining counts was to locate the area visited by the rodents after a treatment, find the centre line of this attack, and take counts on 50 plants on either side of this centre line. Compared in this way, the respective percentages of destroyed plants on a treated and control row were 0 and 28, which more closely represents the relative effect observed in the field.

In the case of a migratory pest, where the area visited can be located, the results of control experiments are preferably to be obtained by taking counts on either side of the centre line of attack. Further, in laying down such experiments, it is advisable to treat large areas with a view to making counts on those visited by the pest rather than treating a number of small experimental plots of which only a few would be visited. The results of such experiments are better presented as a descriptive account.

Summary.—During the summer of 1929, young mangold plants on farms in Caernarvonshire were destroyed by rodents, chiefly hares, causing considerable loss. Destruction, which took place shortly after the plants were thinned, was due to the complete severance of the root.

(2) Farmers were generally mistaken as to the cause of the trouble. Instances of wrong diagnosis are given, also a comparison of this damage with that caused by springtails (*Collembola*).

(3) Control experiments were undertaken to find a repellent capable of protecting the young plants until they had outgrown the critical stage of attack. Materials tried included (*a*) naphthalene, (*b*) a proprietary article, (*c*) paraffin on sawdust, and (*d*) pine tar oil on sawdust.

(4) In these experiments, (*b*) and (*d*) proved ineffective, and (*a*) the most effective. The naphthalene was first applied as a dusting near the plants (1¼ lb. per 100 yards run of row), but later it was incorporated in a top dressing of nitrate of soda (14 lb. of naphthalene in 1½ cwt. of nitrate of soda). It proved advisable to treat the entire mangold crop, and this method was effective in causing the hares to cease visiting the field on their nightly tour.

(5) The accumulation of data in control experiments in the case of a migratory pest, where the area visited by the pest can be located, is discussed. It is suggested that, in such case, counts should be taken on either side of the centre line of attack and not necessarily on all the plots laid down. Further, the results are best given as a descriptive account.

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JUNE ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,
Director of Agriculture for West Sussex.

Bare Fallows.—The practice of leaving land entirely free of crop for a season, during which various cultivations are carried out is one of the oldest in agriculture. Before the introduction of artificial manures and concentrated feeding stuffs with valuable manurial residues, bare fallows were necessary to restore fertility. The introduction of potatoes, turnips and other "root" crops into the farm rotations has provided an opportunity to secure the cleaning effects of the bare fallow and at the same time grow a crop which can be sold or fed to farm stock. In some districts the practice of bare fallowing is now almost unknown; in others it persists and has a tendency to increase. The area so treated varies from year to year, and may be increased as the result of a wet summer which has encouraged a strong growth of weeds in cereal crops, or of a wet autumn which has made autumn cleaning impossible, or of a wet spring which has delayed cleaning operations until it is too late to sow a crop. There is also a considerable area which is deliberately set apart to be cultivated as a bare fallow, and on heavy clay soils, particularly in districts not subject to severe winter frosts, it is a real

necessity in order to obtain a satisfactory tilth. Before the War, the bare fallow area was about 3 per cent. of the arable area in England and Wales; in recent years the area of bare fallow has been actually and relatively higher, and is now about 4½ per cent. of the arable area.

The years immediately after the War were notable for the large amount of land cultivated as bare fallow, the amount recorded in 1919 being the largest for 35 years. This increase could be accounted for by the large acreage of grassland which was broken up to produce cereals, much of it having become very weedy and requiring cleaning. The increase at the present time may be due to the higher cost of labour and a desire to concentrate the "root" area, which requires much hand labour, on land that is most suitable. The object of the bare fallow is to clean the land thoroughly and to improve the tilth. In semi-arid climates where the annual rainfall is insufficient to grow a full crop, a bare fallow is used to accumulate a reserve of moisture.

The actual cultivations vary with the type of soil, weather conditions and the type of weeds to be dealt with. Heavy clay soils of a noted wheat and bean character are the most common subjects for bare fallowing. Ploughing should be done first in the usual way, and next cross cut, that is, ploughed across the furrows, leaving the land in rough blocks in such a way as to fully expose it to sun and wind in order that it should be dried and baked right through. No attempt should be made to produce a tilth until all efforts to obtain the baked condition have failed. The weather during June is an important factor, and unless the baking and drying have been accomplished before the end of June, the growth of weeds will necessitate a change in methods. Cultivations will require to be frequent if the earlier work has failed to kill the weeds. Thistles are often most persistent, and care should be taken to ensure that the plough cuts the main roots. It sometimes happens that land is bare-fallowed to reduce the prevalence of annual weeds such as charlock and wild radish. In such cases, the procedure must be to work down to a tilth in order to encourage the germination of seeds, and to repeat this as often as possible, each fresh working destroying the previous growth of weeds. In all cases when land has to be worked down to a tilth in July, and especially on the lighter types of soils, a cover crop should be sown in order to take up the soluble nitrates which will have been formed during the summer cultivations, and to provide a green crop which could

either be fed off by sheep or ploughed in for green manure. Mustard is a suitable crop for this work, the seed being cheap and the growth rapid : 20 lb. of seed broadcast per acre will suffice. The benefits of a well-managed bare fallow are considerable, and nothing could better illustrate these than the results obtained at Rothamsted by bare-fallowing part of the Broadbalk Field in 1926 and 1927. The following table, which is published in the Rothamsted Experimental Station Report, 1927-28, needs no comment :—

	1928 : *Bare-fallowed* 1926 *and* 1927		*Average* 77 *years* 1852-1928	
	Grain, bushels per acre	*Straw*, cwt. per acre	*Grain*, bushels per acre	*Straw*, cwt. per acre
Plot 3. No manure since 1839	27·9	27·8	11·8	9·9
,, 13. Complete Artificials ..	55·2	32·0	29·2	30·8
,, 11. No Potash	56·9	31·4	21·4	21·8
,, 10. No Potash or Phosphate	47·0	25·8	18·8	18·1
,, 5. No Nitrogen	35·2	34·8	13·6	10·6
,, 23. Farmyard Manure ..	48·4	61·4	33·2	34·5

Arable Crops.—In the south of England, kales, swedes and turnips can still be sown, root singling and haymaking are in full swing, and the month is a very busy one.

In the north, root sowing will soon finish, and as haymaking is later, there is at this period a slacking off in urgent work. Growth is now sufficiently advanced to enable an opinion to be formed as to the success or otherwise of the cereal crops. The effects of cultivation and manuring can now be noted, and the efficiency of the distribution of manures, particularly the top dressings of nitrogenous manures, will be in evidence. The difficulty of distributing small dressings of any manure is a very real one, and is most noticeable with the quick-acting nitrogenous manures applied as top dressings. When examining cereals at this season, due regard should be paid to the particular variety. Cereal variety trials, which are common in many counties, indicate wide differences in breadth of leaf, tillering capacity and colour, all of which are particularly noticeable at the present time. It is too early to draw conclusions as to the most profitable variety ; the standing power of the straw, the size of ear and the final yield of grain must be noted later. Wheats such as Victor and Square Heads Master often present a much better appearance at their present stage of growth than a variety such as Yeoman, but the yields at harvest may not quite fulfil the promise during early growth ; indeed, it is a common saying that Yeoman always thrashes out better than was expected.

Weeds.—Weeding will everywhere be a common feature of farm work. Docks must be dug and removed, thistles can be spudded, and in the north there is still time to destroy charlock by sprays or powders.

Thistles on any land are an eyesore, and, unless they are spudded out of cereal crops, they will ripen their seed before harvest. It is often asserted that the seed of the common field or creeping thistle will not grow ; it is not wise to trust it. Fortunately the seeds that blow about so freely in the autumn do not all grow, but very many can and do germinate. This weed maintains its numbers and spreads principally by underground stems, which readily form separate plants when severed from the parent root ; it is thus possible to increase it greatly by the cultivation of arable land. Deep ploughing, using a wide share, to ensure cutting of all the main roots, is a means of weakening the plants and ultimately reducing the numbers. On pastures, repeated cutting is necessary to exhaust the vigour of the underground stems. Cutting should be done in June, July and August, and if this is repeated two years in succession the number will materially diminish. In the intensive close grazing system, the dressings of nitrogen appear to make the thistles palatable to cattle, and they are freely eaten and tend to disappear. Many farmers assert that thistles should not be cut till they are nearly mature, and that if cut just after flowering they will bleed to death ; those who act on this belief will always have thistles.

Charlock is one of the most aggressive weeds of arable land, and is particularly bad in certain districts and on particular fields. The name " charlock " is commonly applied to more than one species of weed, and in comparing systems of eradication it is necessary to know exactly which species is being considered. The true Charlock (*Brassica sinapis*) is the most widely distributed and the easiest to destroy. Spray fluids, such as 60 gallons per acre of 4 per cent. copper sulphate solution, are fairly effective if applied as a fine spray, and if the weather remains dry until the spray has had effect. Dry powders can also be effective if weather conditions suit ; in this case the plant must be moist, preferably with dew, when the powders are applied, and a dry sunny day following the application is essential. Finely ground copper sulphate may be used if a power spraying machine is available ; 4 to 8 cwt. of dry powdered kainit or 2 cwt. of calcium cyanamide per acre may be broadcast under similar conditions, and when the whole circumstances are favourable good results are obtained.

Wild radish (*Raphanus Raphanistrum*), sometimes called jointed charlock or runch, is less generally distributed than true charlock, but is not so easily destroyed by sprays. Where it is very bad, a bare fallow with repeated cultivations to germinate the seed and destroy the young plants is often advisable, and if such a bare fallow is followed by a root crop, much benefit will result. Where the weeds are not thick much good can be done by hand weeding; in this case all plants should be carried off the field and destroyed, as a plant in full flower may still ripen some of its seeds if merely pulled up and thrown down.

* * * * * *

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended May 14.				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) .. *	10 2*d*	10 2*d*	10 2*d*	10 2*d*	13 0
Nitro-chalk (N. 15½%) .. *	9 19*d*	9 19*d*	9 19*d*	9 19*d*	12 10
Sulphate of ammonia :— Neutral (N. 20·6%) .. .. *	10 2*d*	10 2*d*	10 2*d*	10 2*d*	9 10
Calcium cyanamide (N. 20·6%) *	9 6*e*	9 6*e*	9 6*e*	9 6*e*	9 0
Kainit (Pot. 14%) .. .. §	3 6	2 19	2 19	3 3	4 6
Potash salts (Pot. 30%) .. §	5 3	4 18	5 0	4 19	3 4
" (Pot. 20%) .. §	3 15	3 9	3 8	3 11	3 7
Muriate of potash (Pot. 50%) §	9 17	9 3	9 2	9 5	3 8
Sulphate,, " (Pot. 48%) §	11 19	11 6	11 5	11 5	4 8
Basic Slag (P.A. 15¾%)‖ .. §	2 13*c*	2 3*c*	..	2 9*c*	3 1
" (P.A. 14%)‖ .. §	2 7*c*	1 16*c*	1 16*c*	2 3*c*	3 2
" (P.A. 11%)‖ .. §	..	1 9*c*	1 9*c*	..	..
Ground rock phosphate (P.A. 26-27½%)‖ .. .. .. §	2 2*a*	2 10*a*	2 5*a*	2 2*a*	1 7
Superphosphate (S.P.A.16%).. §	3 11	..	3 9	3 6	4 2
" (S.P.A.13¾%).. §	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3¾%, P.A.20½%) §	8 15	8 10	8 12	7 15	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%) .. .. §	5 17*b*	5 15*f*	6 10	4 15	..

Abbreviations: N. = Nitrogen; P.A. = Phosphoric Acid; S.P.A. = Soluble Phosphoric Acid. Pot. = Potash.

* Prices are for not less than 6 ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 80% through standard sieve. *a* Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

NOTES ON FEEDING STUFFS

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Summer Grass.—Something like 60 per cent. of the agricultural area of England and Wales is devoted to growing grass, so that its proper management and utilization are matters the importance of which it is impossible to exaggerate. In the past, agricultural scientists (with a few notable exceptions) have tended to neglect this very important crop, but in recent years its study has become very popular, and results of far-reaching practical bearing have emerged. During the present depression, the fact that grass farming needs less labour is leading farmers to lay down more and more of their land to permanent pasture. Though this is regrettable, it may nevertheless be true that on many farms the only method of tiding over the present time is to cut commitments and labour by sowing down. This policy, however, will serve its purpose only if grass is thoroughly understood, and it is desirable that the latest knowledge of all phases of the crop should be widely distributed, and put into practice as experience justifies.

The conclusions of Dr. Woodman and his colleagues at Cambridge have received very considerable publicity, but their importance is such that they will bear any amount of repetition. Briefly, then, they find that *young* grass is, apart from the water which it contains (which amounts to approximately three-quarters of its weight), a concentrated food characterized by a very high protein content, and that this is true all through the growing season if, and only if, it is kept short. As grass gets older, however, it loses its concentrated character and becomes fibrous, less digestible, and poorer in protein. The facts on which these conclusions are based have been obtained with great care in several different seasons, and on different soils, so that there can be no doubt of their truth: the difficulty arises in applying this information so that the greatest return may be obtained from each acre.

Now, under what must still be regarded as normal or usual grazing conditions, grass is definitely not kept in a short state all the summer: there is a large growth in May and the grass usually gets right away from the stock, with the consequence that during June the herbage consumed has got past its very nutritious stage and become more suitable for maintenance than for production. The subsequent state of affairs depends

very largely on the weather: under our normal conditions the stock get the upper hand again some time in July, and if dry weather follows this the pastures get very bare. Generally, however, we get considerable rain in July, and consequently we experience a second, though very much less marked, flush of grass. All these changes in the state of the grass that is being eaten are faithfully reflected in the yields of milking cows, which serves to emphasize the very practical importance of Dr. Woodman's findings. What is desired is so to stock the land that the grass is always kept reasonably short (not more than "hand high"), but in many cases this is clearly a counsel of perfection, and if followed slavishly might land the farmer into any amount of trouble. Obviously, if sufficient stock are in hand in May they will go hungry later on—the great fault of grass as a crop being that its growth rate is so very dependent on the weather. No farmer wants bare pastures in July and August, though in actual fact their stock-carrying capacity is probably higher than their appearance indicates: this was noticed last year by many farmers whose stock did surprisingly well during the drought, and it was suggested that the explanation lay in the fact that the very limited keep consisted of very short, very young, and therefore very nutritious, herbage.

Despite this, however, there can be no doubt that it would be very bad policy to stock fully in May and to leave the stock to the mercy of the weather for their food later on; or to commit oneself to costly provision of much other food; or to sell largely when the dry conditions supervened, on what would undoubtedly be an unfavourable market. Consequently, a middle course has to be adopted: under-stocking in May is done deliberately, and this becomes over-stocking some time later in the summer. In this way we have arrived at an apparently sound system of supplementing pasture with other foods, as it becomes relatively bare in July and August. An alternative is now being suggested—rotational close grazing—but on many farms this middle course may be the best business, at least until the newer method has had a more extended trial and its economic possibilities have been more thoroughly tested. Thus, supplementing pasture seems to arise naturally as a logical outcome of an apparently sound policy: the tragedy of it is that lack of knowledge, which is only just being rectified, has developed a system which is fundamentally wrong on one or two crucial points.

The first mistake is to assume that supplementary feeding

is not required until a shortage of grass is patent to the eye—in other words until some time in July, the actual date varying with the season. This, it will readily be realized, is directly contrary to the teaching of recent research. Stock do well in May, not because they stand inches deep in grass, but because that grass is young and growing. By mid-June, though there still may be plenty of grass, the fundamental requirement—that it should be young and growing—is absent: what the stock are eating then is a sort of watered hay, and excellent though hay may be as the maintenance part, its dry matter is generally recognized to have too low a starch equivalent for extensive use as the productive part of the ration. This much follows from the newer knowledge of the feeding value of grass at different stages of growth, but the argument may be clinched absolutely by turning to the only type of animal whose daily production can be, and is, measured on a large scale—dairy cows. Averages of large numbers of records showed that yields declined at the rate of over three-quarters of a gallon a week during June, compared with less than one-third of a gallon during the winter, and that June gave a much more rapid fall than the recognized bad months of July, August, and September. May grass is concentrated food, but under normal conditions when this is deliberately (and probably advisedly) permitted to gain on the stocking, June grass is a different thing altogether, and should be regarded as insufficiently nutritious for high production. Thus the first point that must be made is that supplementary feeding should be started at least a month earlier than is commonly the case: that is, whilst there is still plenty of grass to be eaten, but in recognition of the fact that it is no longer young. Under present methods much harm is done before it is realized, and the view that prevention is better than cure should be adopted.

As to the actual manner of supplementing pasture, the common one is to assess the herbage eaten at maintenance plus x gallons of milk, x being taken at about four in May and June, three in July, and two in August. The difficulty of accurate assessment is obvious, but, if it is based on the state of the field rather than on a rigid time table, experienced stockmen might succeed reasonably well. Having made this estimation, all those cows giving higher yields are fed a balanced ration for every gallon of milk they are giving over and above the assessed value of the grass. Here, of course, there is great scope for skill, for if the supplement is to June grass (plenty

of it, but fibrous), a balanced cake mixture may be permissible, though probably less protein would suffice, but if it is to bare pastures in July (lack of food in the field, but what there is being highly nutritious) then the supplement should certainly consist of the cheaper starchy foods, such as cereals.

Here, again, something seems to be wrong: this method

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	5 14
Maize	81	6·8	7 15
Decorticated ground nut cake	73	41·0	8 15
" cotton cake	71	34·0	10 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·73 shillings, and per unit protein equivalent, 1·93 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	7 3
Oats	60	7·6	5 18
Barley	71	6·2	6 15
Potatoes	18	0·6	1 12
Swedes	7	0·7	0 13
Mangolds	7	0·4	0 13
Beans	66	20·0	7 13
Good meadow hay	37	4·6	3 13
Good oat straw	20	0·9	1 16
Good clover hay	38	7·0	3 19
Vetch and Oat silage	13	1·6	1 6
Barley Straw	23	0·7	2 1
Wheat straw	13	0·1	1 3
Bean straw	23	1·7	2 3

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d. net.

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British..	—	—	9 0	0 12	8 8	72	2 4	1·25	9·6
Barley, British feeding ..	—	—	7 0	0 9	6 11	71	1 10	0·98	6·2
" Canadian feed	19 0	400	5 7*	0 9	4 18	71	1 4	0·71	6·2
" Danubian	19 6	"	5 10*	0 9	5 1	71	1 5	0·76	6·2
" Persian..	20 0	"	5 12	0 9	5 3	71	1 5	0·76	6·2
" Russian..	22 6	"	6 7	0 9	5 18	71	1 8	0·89	6·2
Oats, English, white	—	—	6 13	0 10	6 3	60	2 1	1·12	7·6
" " black and grey	—	—	7 0*	0 10	6 10	60	2 2	1·16	7·6
" Argentine	15 6	320	5 8	0 10	4 18	60	1 7	0·85	7·6
" Chilian	16 6	"	5 15	0 10	5 5	60	1 9	0·94	7·6
" German	20 6	"	7 3	0 10	6 13	60	2 3	1·20	7·6
Maize, Argentine	32 9	480	7 13	0 10	7 3	81	1 9	0·94	6·8
" South African	34 0	"	7 18§	0 10	7 8	81	1 10	0·98	6·8
Beans, English winter ..	—	—	8 10†	1 4	7 6	66	2 3	1·20	20
" Chinese	—	—	9 15§	1 4	8 11	66	2 7	1·38	20
Peas, English blue	—	—	8 12†	1 1	7 11	69	2 2	1·16	18
" Japanese	—	—	15 15§	1 1	14 14	69	4 3	2·28	18
Dari	—	—	7 5	0 11	6 14	74	1 10	0·98	7·2
Milling offals—									
Bran, British..	—	—	4 17	1 1	3 16	42	1 10	0·98	10
" broad	—	—	6 0	1 1	4 19	42	2 4	1·25	10
Middlings, fine, imported ..	—	—	6 5	0 17	5 8	69	1 7	0·85	12
" coarse, British ..	—	—	5 10	0 17	4 13	58	1 7	0·85	11
Pollards, imported	—	—	5 2	1 1	4 1	60	1 4	0·71	11
Meal, barley	—	—	7 2	0 9	6 13	71	1 10	0·98	6·2
" maize	—	—	8 7	0 10	7 17	81	1 11	1·03	6·8
" " South African ..	—	—	7 5	0 10	6 15	81	1 8	0·89	6·8
" " germ	—	—	7 2	0 15	6 7	85	1 6	0·80	10
" locust bean	—	—	8 0	0 7	7 13	71	2 2	1·16	3·6
" bean	—	—	10 10	1 4	9 6	66	2 10	1·52	20
" fish	—	—	19 0	3 3	15 17	53	6 0	3·21	48
Maize, cooked flaked	—	—	9 7	0 10	8 17	83	2 2	1·16	3·6
" gluten feed	—	—	7 15	0 19	6 16	76	1 9	0·94	19
Linseed cake, English, 12% oil	—	—	12 0	1 9	10 11	74	2 10	1·52	25
" " " 9% "	—	—	11 2	1 9	9 13	74	2 7	1·38	25
" " " 8% "	—	—	10 17	1 9	9 8	74	2 6	1·34	25
Soya bean cake, 5½% oil ..	—	—	9 7*	2 0	7 7	69	2 2	1.16	36
Cottonseed cake—									
English, 4½% oil	—	—	5 15	1 7	4 8	42	2 1	1·12	17
" " Egyptian, 4½% "	—	—	5 5	1 7	3 18	42	1 10	0·98	17
Decorticated cottonseed meal, 7% oil	—	—	10 0*	2 0	8 0	74	2 2	1·16	35
Ground-nut cake, 6-7% oil ..	—	—	7 0†	1 7	5 13	57	2 0	1·07	27
Decorticated ground-nut cake, 6-7% oil	—	—	8 15†	2 1	6 14	73	1 10	0·98	41
Palm kernel cake, 4½-5½% "	—	—	6 15†	0 17	5 18	75	1 7	0·85	17
" " " meal, 4½% "	—	—	7 5†	0 17	6 8	75	1 8	0·89	17
" " meal 1-2% oil ..	—	—	6 0†	0 18	5 2	71	1 5	0·76	17
Feeding treacle	—	—	6 7	0 9	5 18	51	2 4	1·25	2·7
Brewers' grains, dried ale ..	—	—	5 5	0 17	4 8	48	1 10	0·98	13
" " " porter	—	—	4 17	0 17	4 0	48	1 8	0·89	13
Malt culms	—	—	7 0§	1 6	5 14	43	2 8	1·43	16

* At Bristol. † At Hull.

carries with it the assumption that June grass, if assessed at maintenance plus three gallons (and it is rarely or never assessed at less), is a sufficiently good food to keep the milk yield up to normal in the case of any cow giving less than three gallons. In actual fact, during June, low yielders fall away at about the same rate as high yielders. In a large group of Norfolk cows, picked out as the lowest in producing power of three groups, and averaging only just over two gallons a day at that time, the June rate of fall was about two-thirds of a gallon a week, compared with less than one-third of a gallon a week during the winter. This cuts right across our common methods of supplementing pasture, and suggests that these methods are not based on a sound principle.

What we are (or should be) supplementing in June is not a shortage of food but a fodder suitable only for maintenance. During winter, when all the food is under control, we recognize clearly which are the foods put in for maintenance and which for production: both are rationed, and the best practice now is to feed the cake ration first and then the coarser foods, so that the cow may be able to deal adequately with the former and eat to comfortable repletion of the latter. It seems that in summer we must manage affairs somewhat similarly, and this involves rationing grass. It has already been suggested by several eminent authorities that high-yielding cows should not be out at grass all day long, and it appears that restriction of grazing would be desirable for the whole herd. On the majority of farms this could surely be managed with little if any extra expense, and it would enable almost as strict a control of the whole ration to be kept in summer as in winter. Our present system is like feeding cows in winter on carefully calculated rations, but with hay continuously *ad lib.* Some change in this direction might do much to help raise our summer management of dairy cows towards the noticeably higher level we achieve during the winter.

* * * * * *

MISCELLANEOUS NOTES

A Farming Tour in Canada

DURING August and September next, a tour in Canada will be made by a group of farmers from Great Britain. The arrangements are being made by the British National Union, and anyone interested should apply to the Secretary, 218 Moorgate Station Chambers, London, E.C. 2, who will be pleased to supply a brochure descriptive of the tour, and any other desired information. Those who join the party will have a good opportunity of making acquaintance with the methods and machinery used in Canadian agriculture, and will travel through some of the finest scenery in the world.

The Union, which has already carried out successful tours in South Africa, New Zealand, Australia and this country, was founded by the late Sir Pieter Stewart-Bam with the object of strengthening the bonds of Empire by promoting friendship between the farmers of the Dominions.

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The Agricultural Index Number

PRICES of agricultural produce during April were on average 36 per cent. above those ruling in the corresponding month of the base years, 1911-13, as compared with 39 per cent. in March and 46 per cent. in April, 1929. The fall of three points in the general index number during the period under review was caused principally by the lower indices recorded for fat stock, potatoes, hay and wool, while butter also showed a decline. On the other hand, the index figures for grain, eggs and milk were higher than in March.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925:—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	36
May	57	50	42	54	44	—
June	53	48	41	53	40	—
July	49	48	42	45	41	—
August	54	49	42	44	52	—
September	55	55	43	44	52	—
October	53	48	40	39	42	—
November	54	48	37	41	44	—
December	54	46	38	40	43	—

Grain.—For the first time this year, prices of wheat and oats moved upwards, both types of grain becoming about 4d. per cwt. dearer on the month, and the index numbers advanced by 2 and 4 points respectively to 14 per cent. above and 11 per cent. below the pre-war levels. In the case of barley, however, quotations showed a further slight fall, but owing to the proportionately greater decline that took place in the base period, the index was 2 points higher at precisely the pre-war figure.

Live Stock.—Fat cattle prices were well maintained during April, but the index number fell by 4 points to 33 per cent. in excess of 1911-13, while fat sheep fell slightly to 50 per cent. above pre-war. The check to the prolonged rise in values for fat pigs which was recorded in March was followed by an appreciable reduction in prices during April, amounting in the case of bacon pigs to nearly 1s. 6d. per score lb. and for pork pigs to 1s. 9d.; the index number for the former was 14 points lower at 76 per cent. and for the latter 16 points down at 80 per cent. above the base level. Quotations for dairy cows fell slightly, but as the reduction was proportionately the same as in the base period, the index figure was unchanged at 30 per cent. in excess of 1911-13. Store cattle were again rather dearer, but the index number declined by 2 points to 24 per cent. above pre-war. Store sheep displayed a similar movement, a small increase in price being accompanied by a drop of 5 points in the index figure. In sympathy with the downward trend of fat pig prices, values for store pigs fell by about 3s. 6d. per head and the index number was 12 points lower at 113 per cent. above pre-war.

Dairy and Poultry Produce.—With the transition from winter to summer prices milk became about 3½d. per gallon cheaper on the month, but the index number was 3 points higher at 58 per cent. in excess of the 1911-13 level. Prices of cheese remained very firm at an average of 41 per cent. above pre-war. Values for butter were substantially reduced, and the index figure fell by 7 points to 30 per cent. above that of the base period. Eggs also were again a little cheaper, but as the drop was proportionately less pronounced than between March and April of 1911-13, the index number rose by 9 points. Poultry prices were rather higher at about 55 per cent. above pre-war.

Other Commodities.—There was a further fall in potato prices during the period under review and the index number depreciated by 15 points to 39 per cent. below the 1911-13 level. A year ago potatoes were realizing nearly double the prices realized this April. Quotations for both clover and meadow hay were reduced by about 2s. 6d. per ton and the relative index figures were 4 and 5 points lower at 32 per cent. and 28 per cent. respectively above the base levels, the combined index for hay coming out at 30 per cent. Wool again became cheaper at only 3 per cent. in excess of pre-war.

Index numbers of different commodities during recent months and in April, 1928 and 1929, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13.

Commodity	1928	1929	1930			
	Apl.	Apl.	Jan.	Feb.	Mar.	Apl.
Wheat	34	30	30	21	12	14
Barley	41	32	7	Nil	—2*	Nil
Oats..	64	36	1	—8*	—15*	—11*
Fat cattle	43	31	38	37	37	33
Fat sheep	78	53	67	56	52	50
Bacon pigs	43	73	90	95	90	76
Pork pigs	45	74	98	99	96	80
Dairy cows..	34	29	33	31	30	30
Store cattle..	22	18	25	26	26	24
Store sheep..	46	54	55	49	48	43
Store pigs	35	71	137	135	125	113
Eggs	37	45	40	51	31	40
Poultry	41	38	44	41	52	55
Milk	63	77	67	67	55	58
Butter	55	51	44	43	37	30
Cheese	78	76	37	39	40	41
Potatoes	94	15	—4*	—14*	—24*	—39*
Hay	11	10	38	34	34	30
Wool	71	59	32	18	11	3

* Decrease.

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Summer Demonstrations at Rothamsted and Woburn

FACILITIES for summer visits to the Rothamsted and Woburn Experimental Stations will again be provided during the present season, and the Director, Sir John Russell, will be happy to arrange for associations and clubs of farmers and farmworkers, chambers of agriculture and horticulture, students' societies, and others interested in agriculture and horticulture, to inspect the experimental plots at these two stations between now and October 30. Mr. H. V. Garner and Captain E. H.

Gregory will be available as demonstrators, and there is sufficient at each station to occupy a full day, even if the weather is too unfavourable to permit of close investigation of the fields. It is not possible to combine both stations in one visit.

At Rothamsted, where the soil is heavy, the experiments deal with the manuring of arable crops, especially sugar beet, potatoes, mangolds, fodder mixtures, barley, oats, wheat and meadow hay. Rotation experiments are in progress comparing (1) various types of straw manure with dung made in the ordinary way; (2) different levels of manuring with nitrogen, phosphate and potash, respectively. Other experiments deal with the effect of modern slags and mineral phosphates on arable land and hay land; crop diseases and pests; the laying down of land to grass. There are also demonstrations of modern implements, tractors and good types of tillages.

On the light soil at Woburn, the experiments are concerned more particularly with the manuring of potatoes, sugar beet, malting barley and wheat, and the use of green manures.

It is desired that, whenever possible, arrangements for visits should be made beforehand, although, as farmers' movements must depend a good deal on the weather, no farmer need stay away because he has been unable to fix a date in advance. Visits from small groups of farmers are especially welcomed. All communications about proposed visits should be addressed to the Secretary, Rothamsted Experimental Station, Harpenden, Herts, who will be glad of ample notice, and suggested alternative days, to avoid the possibility of visits clashing.

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The World's Wool Markets.—A careful analysis of the methods adopted for marketing wool by producers in the different countries of the world has been published by Arnold Frobisher, B.Sc., F.S.S., Secretary to the British Research Association for the Woollen and Worsted Industries, Ltd., in the *International Review of Agriculture*, Part II, *Monthly Bulletin of Agricultural Economics and Sociology*, for October and November, 1929. The essay is quite comprehensive, including all five continents, and the detailed information it contains, which is extremely informative, has led to a number of interesting conclusions set out briefly in a summary at its end. Since these conclusions are of interest, and will be of assistance to all those whose business would lead them to a consideration of existing methods and the lines along which development and improvement may be expected, they may usefully be given in full:—

"It appears," says Mr. Frobisher, "from a detailed consideration of the various wool-producing countries, that the more advanced industries market their wool by means of central auction sales. This

method is found to lead to the determination of a price satisfactory to both buyers and sellers, as it gives to both the opportunity to make comparisons between the many types of wool offered in the one centre. In countries where sheep are still kept on the small flock system by primitive shepherds marketing arrangements are made by merchant houses who buy through their travelling agents. The wools marketed in this way are the coarse and carpet wools, the finer wools coming from carefully selected flocks in countries which produce on the large flock system. In Australia and in South America, the largest wool-producing countries, sale is almost entirely by auction in coastal centres, arrangements being made by brokers selling either on a fixed brokerage or on a commission basis. South Africa is following suit and has established large auctions in the wool selling centres.

"The services of co-operative associations in providing carriage, grading and storing facilities are most valuable, especially where it is not possible for the grower to superintend personally the sale of his clip.

"In Great Britain and on the Continent of Europe selling by co-operative methods is increasing in extent. From the farmer's point of view many advantages are to be obtained from such sale. Though the individual farmer in a particular year might find it better to sell his clip privately, over a period of years the average price obtained tends to be higher when sale is through a properly managed co-operative society. The chief disadvantage from the farmer's point of view is that payment has to be deferred for some time. In most cases the society overcomes this difficulty by making an advance of 50 per cent. or 70 per cent. of the estimated value of the wool. This action, in its turn, increases the need for financial strength on the part of the association. This probably accounts for the drift towards larger societies organized on the lines of joint stock companies whose shareholders are usually the wool growers, and towards a combination of a selling co-operative society with a credit bank, which is a definite movement. The power to hold stocks until the market is at the most favourable point is another advantage of marketing co-operatively, especially when advances are made as loans to the farmer.

"Co-operative societies are exercising more and more an educative function towards their members, and in this respect wool-buyers find them an advantage to themselves. The manufacturer can use the society as a means to explain his wants to the sheep-grower, to tell him why, for instance, tar branding is harmful to the fleece in manufacture. It is felt more and more that close contact between grower and manufacturer is essential to the recovery of the industry, and producers' organizations offer a medium for contact.

"It has been said that those farmers who sell their wool through staplers obtain a higher reward for it than do those who sell through a co-operative society, although the aim of the society is to eliminate the middleman. It is obvious that the monetary advantages of selling through a co-operative organization depend on the efficiency of the concern. In the case of a badly managed society, or even of a society which has not expanded to its size of maximum efficiency, the prices received may fall below those obtained by sale through private treaty. Also, it is probable that the owner of a poor clip may obtain a higher price for it in a private bargain than the co-operative society would secure for him in a public sale.

"One must balance the statements that co-operative marketing societies have so far proved costly failures—and large numbers of them have failed—and the fact that Australia and New Zealand, which produce the best wool in the world, do so without any form

of producers' co-operative organization against the equally important facts of the improvements that are admittedly due to co-operation in the wool trades of Canada, South Africa and the United States. Co-operative marketing is a new departure and must be given time to justify itself."

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Special Minimum Rates of Wages for the Hay Harvest.—As in previous years, certain Agricultural Wages Committees have fixed special minimum rates of wages for employment on the hay harvest, such rates taking the form of special differential rates for overtime employment on harvest work. In every case, the rates are similar to those fixed last year, being 10d. per hour for male workers of 21 years of age and over in Devonshire, Dorset, Somerset and Herts (the last Committee has not yet confirmed its proposal) and 9d. per hour in Wiltshire, whilst, in the case of Hertfordshire, special overtime rates are proposed for female workers, the rate for such workers of 19 years of age and over being 7¾d. per hour.

Copies of the Orders in full may be obtained, free of charge, on application to the Secretary of the Agricultural Wages Board, 7 Whitehall Place, London, S.W. 1.

Except in the areas mentioned above, no special rates for employment on the hay harvest are applicable, and in consequence the ordinary minimum and overtime rates continue to apply during the harvest period.

* * * * * *

Enforcement of Minimum Rates of Wages.—During the month ending May 14 legal proceedings were instituted against 14 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

County	Court	Fines			Costs			Arrears of wages			No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	d.	
Durham ..	Durham ..		*		3	15	6	53	17	6	1
Lancaster ..	Blackburn ..		—		2	12	0	4	10	0	1
,, ..	Bolton ..	4	10	0	0	6	0	145	12	10	6
,, ..	Liverpool ..		—		0	7	0	38	4	0	7
Monmouth ..	Abergavenny	2	0	0	2	10	0	10	6	0	1
,, ..	,, ..	1	0	0	0	8	0	3	15	5	1
,, ..	,,	0	10	0	0	8	0	10	0	0	1
,, ..	,,	1	0	0	0	16	0	24	0	0	2
,, ..	,,	0	10	0	0	8	0	7	0	0	1
,, ..	Raglan ..		—		0	9	0	12	0	0	1
,, ..	Talgarth ..		†		0	14	0	8	12	4	1
,, ..	Usk		—		0	15	6	15	0	0	1
Salop ..	Whitchurch	1	10	0		—		31	4	0	3
Sussex ..	Lewes ..	4	0	0		—		9	2	9	1
		£15	0	0	£13	9	0	£373	4	10	28

* Dismissed under Probation of Offenders Act.

† In addition, proceedings were taken against this employer under Section 9 (3) (d) for giving false information, and a fine of £5 was imposed.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

Cornwall: Miss J. Philipson, N.D.D., has been appointed Assistant Instructress in Dairying, *vice* Miss M. F. Griffiths, N.D.D., B.D.F.D.

Cumberland: Miss E. M. Blackburn, N.D.D., has been appointed Instructress in Dairying, *vice* Miss H. B. Pirie, N.D.D.

Devon: Mr. A. E. Gunningham* has been appointed Instructor in Horticulture.

Mr. S. A. Westcott has been appointed Assistant Instructor in Horticulture.

Miss A. A. Shearman, N.D.D., has been appointed Assistant Instructress in Dairying, *vice* Miss F. M. Crawter, N.D.D., B.D.F.D.

Hampshire: Miss M. F. Griffiths, N.D.D., B.D.F.D., has been appointed Travelling Dairy School Instructress, *vice* Miss E. M. Gifford.

Kent: Mr. W. G. Kent, N.D.H., has been appointed Instructor in Commercial Fruit Growing (County work), *vice* Mr. N. B. Bagenal, B.A.

Mr. J. N. Sharrock, N.D.A., N.D.D., and Mr. S. J. Travers, M.B.E., N.D.A., P.A.S.I., have been appointed Assistant Agriculturists.

* Wholly employed by the County Council, but only partially on agricultural education work.

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NOTICES OF BOOKS

The Plant Rusts (Uredinales). By Joseph C. Arthur, in collaboration with F. D. Kern, C. R. Orton, F. W. Fromme, H. S. Jackson, E. B. Mains, and G. R. Bisby. Pp. iv+446. (London: Chapman & Hall, Ltd. New York: John Wiley & Sons. 1929. Price 32s. 6d. net.)

Rusts are parasitic fungi that often cause severe diseases in cultivated plants, and they occur also on many wild plants. Their ravages have been known since ancient times, and serious epidemics of them still occur all too frequently. They have been the subject of much study and experimental investigation on the part of mycologists and plant pathologists, and to such individuals the book under review will make a special appeal. It has arisen from work begun not far short of half a century ago at Purdue University, Indiana, U.S.A., the classificatory parts of which have already been published in the seventh volume of the North American Flora. The object of the book is to present a general account of the Rusts, more especially from the bionomic and ecological aspect, and it is the composite effort of seven authors. That there are some disadvantages in plural authorship is frankly recognized in the preface, and it is admitted also that occasional statements in the text are not endorsed by one or more of the several authors. This, however, does not seriously detract from the general value of the book.

The subject matter is treated of in ten chapters, and there is a list of over one thousand references at the end, occupying forty-six pages. It is unfortunate, however, that the places of publication of the works

in this list are, for some reason, omitted. An unusual but useful feature of this list is that under each reference the relevant pages in the text are indicated. The index appears to be only fairly adequate. The first chapter deals with the general nature of the Rusts, and the second presents an historical review of the literature on them. These are followed by chapters on development and classification, and cytology and morphology. The dissemination and geographical distribution of the Rusts are next discussed and there follows a chapter on their physiology. The important problems of specialization are fully dealt with in the light of modern research, and a chapter is devoted to abnormality in, and diseases of, the Rusts themselves. To the practical man and the economist, Chapter IX will be of special interest, for in it are discussed the losses due to Rusts in cereals and grasses, fruit trees (large and small), vegetable and forage crops, ornamental plants, fibre crops and forest trees. In the aggregate, these losses are enormous, and it has to be confessed that, to a large extent, they are not as yet practically preventible, although considerable headway has been made in the development of resistant varieties of certain crops and in the eradication of certain hosts of some of those Rusts that require two for their complete developmental cycle. The last chapter is devoted to a consideration of the methods employed for collecting and preserving Rusts, of studying them microscopically and of cultivating them; and this will prove of service to students of this group of fungi. There are 186 figures interspersed throughout the text. They have been garnered from all quarters of the globe and add much to the value of the book.

The senior author has an international reputation as a specialist in the Rust fungi, and his collaborators are all men of standing in mycological and plant pathological circles. The book, therefore, may be looked upon as "authoritative," although in some matters, as, for instance, in terminology, mycologists outside America may not be inclined to adopt the alteration in old-established names for the "fruiting" structures and the spores that are developed from them in the various phases of the life cycle of a typical Rust fungus. Nomenclature is already, and largely unavoidably, a great source of confusion in the biological sciences; to add to this, when not absolutely necessary, by creating terms like æciospore, urediniospore, teliospore, etc., for the good old-fashioned names æcidiospore, uredospore, teleutospore, etc., seems undesirable. In spite of such predilections, all serious students of mycology and plant pathology will want to possess this book.

Farm and Industrial Tractors. By D. N. McHardy, N.D.A., A.I.A.E., with a Foreword by Dr. Chas. Crowther, M.A. Pp. xiii+238. Illus. (London: Crosby Lockwood & Son. 1930. Price 7s. 6d. net.)

An earlier book, *Modern Farm Machinery*, by this author, received favourable comment in the issue of this JOURNAL for August, 1924, and similar favourable comment may be made upon the present manual, which, in the words of the title page, is designed both for the owner and operator. Its chief distinction is, perhaps, the eminently practical nature of its contents, which are expressed in simple non-technical language readily to be understood "by the people," and it covers the whole story of the tractor from its early development to its present day use on the farm and in industry.

The chapter on early development is interesting, but more practical is that portion of the book which deals with the details of the construction of the machine, and the three chapters on driving, maintenance and possible sources of trouble. The last of which is rather intimidating,

but is toned down by the remark that only a small proportion of these troubles is likely to be encountered on any one machine, even throughout its life. The book also deals adequately with the use of the tractor in each of the farm operations to which it can be adapted, but the chapter treating of the organisation of farm work seems to be slight. The horticultural tractor is mentioned, as are the costs of operation, and the last three chapters cover industrial types, trailers and equipment and some industrial applications. The appendix, containing specifications of leading makes on the British market, will be specially useful to those farmers who have the purchase of a tractor in mind.

Encyclopædia of Agriculture (Handbuch der Landwirtschaft). In five volumes, comprising about 24 parts, published at a subscription price of Rm. 5·80 each. (Berlin: Paul Parey, 28-29 Hedemannstrasse, S.W. 11.)

This encyclopædic work on agriculture, of which an introductory notice appeared in this JOURNAL in May, 1929, is now practically complete, and since the numbers already published have completed some of the volumes the time is now ripe for a further indication of the contents of what must be regarded as the most authoritative general work on agriculture that has been produced in Germany during the post-war years.

It is not possible in the space at command for the purpose to give a complete critical review of such a work, but it will perhaps suffice to indicate the nature of the contents of the different volumes. Volume I has the general title of *Agricultural Economics*, and is divided into 11 sections, each written by a specialist in his subject, and the reputations of these writers are in some cases not confined to their native country, but are recognized throughout the world. Amongst these may be mentioned Professor Dr. K. Ritter, who has contributed the first essay on *The History of the World's Agriculture*, while Professor Dr. Aereboe, one of the general editors of the *Handbuch*, has contributed the essay, *Farm management and the education of the farmer and of the worker*. The remaining essays in this volume are: *The Agronomo-political bases of agriculture; Material and methods of estate management; Manual labour in estate farming, conditions of employment, payment and performance; Schemes of organization in estate farming; Costings control, net profit and costs of production; The agricultural lease; Financing agricultural undertakings; Market intelligence and market operations;* and *Valuations*.

It may be supposed from some of these titles that there is a larger amount of estate farming in some parts of Germany than in this country, but that factor will not influence the usefulness of the *Handbuch* to agriculturists in many countries.

Vols. II and III deal with the *Science of Field Culture* and *Plant Culture*, and IV and V with *General Animal Breeding* and the *Breeding of the Different Animals*. From the general titles of these volumes, the nature of their contents can be gathered, but a clearer idea of the arrangement of the matter may, perhaps, be indicated. *The Science of Field Culture* includes chapters on such subjects as *Soil Biology; Climate in its Relation to Agriculture; Soil Treatment, Cultivation*, etc., and *Plant Culture* has a chapter on the husbandry of the different crops, both food and forage, as well as fruit and market gardening. The arrangement of the two volumes on animal farming, as indicated in their general titles, is of a similar kind, general principles being enunciated in Vol. IV and the different branches of animal husbandry being covered in Vol. V.

Fungous Diseases of Plants in Agriculture, Horticulture and Forestry. By Dr. Jacob Eriksson. Second Edition. Translated from the German by William Goodwin, M.Sc., Ph.D. 399 illustrations, pp. vii+526. (London: Baillière, Tindall & Cox, 1930. Price 35s. net.)

Professor Eriksson's book on plant diseases was first published in Swedish, and editions in English and in German appeared in 1912. In a considerably enlarged second edition, the book appeared in German in two parts, in 1926 and 1928 respectively, and the volume now under review is the second English edition, translated from the second German one. It incorporates some new material, however, not available at the time of publication of the second German edition. The book is intended to present a general review of the more important fungus diseases that occur in Northern and Mid-Europe on field and garden crops and on some trees of economic or ornamental value. Some of the diseases dealt with do not occur in the regions specified, but they are included because, owing to international trade, it is thought they may put in an appearance at any time.

The "get up" of the book is excellent. It measures 9½ in. by 6½ in.; but, being printed on heavy paper, it weighs 3¾ lb. Misprints are few, but some of the illustrations are poor. Figures like 4 b, 102, 114 a, 118 a, c and d, 215, 276 a and b, and 227 a and b, for example, are not much more than "silhouettes," and are practically valueless. The material is divided into twenty-two chapters, and the diseases are considered in the order of classification of the parasites concerned. Diseases caused by Bacteria and by Myxomycetes are included as well as those due to fungi proper. The Basidiomycetes, however, are dealt with before the Ascomycetes—an unusual arrangement. There is no special chapter on Virus diseases, although some of these are dealt with in the penultimate chapter under the title "Diseases not fully investigated."

References to the literature are given in considerable numbers, but there is little evidence of a guiding selective principle in cases where the literature is very extensive.

In the final paragraph of his preface the author says: "I am conscious of the numerous deficiencies of my book." The critical reviewer, therefore, is rather disarmed, but it would be idle to conceal the fact that, apart from a good deal that is satisfactory in the book, there is much that is disappointing. It would require a great deal of space to refer in detail to the many weak points encountered, and a few examples must therefore suffice. Wart Disease is wrongly stated to affect the roots of potatoes; White Rot and Yellow Disease of Hyacinth are two distinct diseases, but are treated as one; Downy Mildew of the onion is said to occur on species of Lilium and Amaryllis, a statement that few mycologists would accept. Of Silver Leaf it is stated that the disease spreads from the infected root through the whole plant, as if the root were the usual seat of primary infection. The nomenclature of the parasites is often antiquated. The combination *Hypochnus Solani*, for instance, is still retained for the perfect stage of *Rhizoctonia Solani*, and there is no allusion to modern work on the relation of *R. Crocorum* to *Helicobasidium purpureum*.

The author is well known as the originator of the so-called "mycoplasm" theory, and even though it has met with no general acceptance, he may perhaps be forgiven to some extent for enshrining it in his own book. Thus, it is encountered under the Rusts of Cereals and of Hollyhocks. But when it is invoked (and quite unnecessarily invoked) to explain how the potato Blight fungus hibernates, patience is severely taxed. The Potato Wart Disease parasite is stated to appear in young tissue "as an indistinguishable symbiotic plasmodium," whilst it is hinted that "mycoplasm" may have something to do with the Heart Rot of Beet and Mangold, as well as with the hibernation of the Powdery Mildews. Perhaps the most astonishing theory advanced is that concerning the American Gooseberry Mildew. The sap of the plant, infected by the fungus, is supposed to pass in late autumn to the stem and roots, to ascend again in the spring and to give rise to a fresh summer outbreak of the mildew!

The translation reads satisfactorily, but has not been compared in detail with the original. In one or two places, however, the sense has not been captured quite correctly, as, for instance, on page 193 in connexion with the over-wintering of Plum Rust. The translator and the publishers appear to have done their best in the production of the book, but only very extensive editing in the reviewer's opinion by an experienced mycologist could have made it a thoroughly up to date and reliable guide for serious students.

The Principles of Soil Technology. By Paul Emerson, Ph.D. Pp. xv+402. (London: Macmillan & Co., Ltd. New York: The Macmillan Co. 1930. Price 14s. net.)

The writer of this book is the Associate Professor of Soils at the Iowa State College, and has had many years' teaching experience with advanced students of soils and with graduates. This fact necessarily colours the manner of the work, which, however, avowedly sets out to correlate the facts of soil knowledge and to present the science from the teaching standpoint in as fundamental a manner as possible. It is natural, therefore, that the subject should be treated minutely and be completely covered. The arrangement of the contents shows this more certainly than any indefinite statement could. The volume is divided into four parts, viz.:—Soils in general, their formation and classification; the Physical Properties and Functions of Soils; the Chemical Properties and Functions of Soils; and Soil Biology. It is, perhaps, unnecessary to indicate the sub-divisions of these parts, but it may be well to say that the Appendix contains some interesting soil charts, relating, of course, to the United States of America, tables of chemical and mechanical analysis, and a glossary of terms. Since this is the work of an American professor, the necessary illustrations and examples are taken from the soil conditions in that country, but this does not invalidate the work for a British or European student. Wherever a book on soil technology is written, the author would obviously collect his material from the country in which he lives and works, and, if the work were done as meticulously as that under notice, it would be of value, first, to students living in that country and, second, to those students of other countries whose interests are not limited by national barriers.

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ADDITIONS TO THE LIBRARY

Agriculture, General and Miscellaneous

Hurst, A. H.—The Bread of Britain. (79 pp. +4 charts.) Oxford University Press, London: Humphrey Milford, 1930, 2s. 6d. [338.9; 63.311:31; 63.311:38.]

Ministry of Agriculture and Fisheries. The Agricultural Output and the Food Supplies of Great Britain. (55 pp.) London: H.M. Stationery Office, 1929, 1s. [31 (42); 338.9.]

French, C. N. (Compiled and arranged by). A Countryman's Day Book. An Anthology of Countryside Lore. (254 pp.) London: J. M. Dent & Sons, 1929, 6s. [01.]

Conference of Empire Meteorologists.—Agricultural Section. I. Report (16 pp.), 1s.; II. Papers and Discussions (308 pp.), 1s. British Agricultural Meteorological Scheme: Observer's Handbook (34 pp.) London: Ministry of Agriculture and Fisheries, 1929. [551.5.]

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NOTES FOR THE MONTH

The World's Poultry Congress at the Crystal Palace

ARRANGEMENTS for the great Congress are now complete, and it is interesting to note that no fewer than sixty nations will be represented when the Crystal Palace opens its doors on July 22. The livestock cages are now filled. On the commercial side the trade has exhausted the increase in space which was allotted to meet its needs, and the last vacant places have been eagerly sought after in the galleries.

By the time these lines are printed, it will not be possible to send either plant or livestock. It is understood that the Duke of York will open the Congress at three o'clock in the afternoon of July 22, and that Prince Arthur of Connaught will take the Salute at the Military and Air Pageant on the following Friday evening.

About one hundred and fifty-five papers have been selected for discussion; the extensive programme of entertainment has been completed; the Government is adding to its hospitality by offering a dinner to the official overseas delegates on the evening of Wednesday, the 23rd. The entries of birds and rabbits amount to upwards of seven thousand, and are representative of all that is best at home and abroad. County Agricultural Organizers and Poultry Instructors have been active on behalf of the Congress, and the Ministry is greatly indebted to them for efforts that have involved a further call upon their busy days. The National Farmers' Union, through its County branches, has also given invaluable aid.

Parties of visitors are coming in considerable groups from many countries, and it is worth noting that, although there is no room for further exhibits and no further space for the trade, it is still possible for those who are interested to join the Congress as delegates or members, and to enjoy all the attendant privileges in return for the very modest subscription of two guineas. Eleventh-hour applications may be sent to The Secretary of the Congress, c/o The Ministry of Agriculture, 10 Whitehall Place, London, S.W.1.

Literature of Food Investigation

THE preservation and transport of food are questions of great importance to the farmers of the Empire because improvements in these respects increase the range of the markets in which their produce can be sold. The Imperial Agricultural Research Conference, realizing the importance of these subjects, recommended that, for the purpose of helping the Research Institutions within the Empire to keep abreast of progress, arrangements should be made whereby the Low Temperature Research Station at Cambridge should issue periodical bibliographies of useful publications dealing with these subjects. Two "Indexes to the Literature of Food Investigation" have been issued, dated, respectively, March and September, 1929. They are published by H.M. Stationery Office, and are sold at 2s. net each. It is proposed to issue the indexes half-yearly, the material in them being arranged under subject headings relating to the different foodstuffs and the branches of science concerned. A very large number of periodicals has been consulted and the appropriate articles indexed, in addition to books and patent specifications. The provision of such bibliographies should be especially useful to research workers at stations in isolated parts of the Empire where facilities for obtaining and examining scientific literature are limited.

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Conference of Rural Women's Organizations

THE second Conference of Rural Women's Organizations to be held in association with the International Council of Women took place at the end of May in Vienna, where the latter body was in quinquennial Session.

A report was furnished of the work carried out by the Liaison Committee of Rural Women's Organizations set up after the Conference in London in 1929. Consideration was subsequently given to the following topics, discussion of which was severally initiated by the speakers whose names are appended :—"Rural Women's Organizations in Relation to the Movement for Preserving and Developing Popular Arts" (Mrs. Silfverhjelm, Sweden), "Marketing Problems as Affecting Countrywomen" (Miss Frysinger, U.S.A. Department of Agriculture), "The Woman's Contribution to Agricultural Output as affected by Agricultural Education" (Miss Pratt, Ministry of Agriculture, London),

"The Countrywoman's Position in respect of Laws made for the whole Community" (Countess Keyserlingk, Germany), "The Co-operation of Town and Countrywomen" (Fou Michelet, Norway), "Ways and Means of Bettering the Position of the Woman Worker on the Land" (Mme. Mrskosova, Czecho-Slovakia). There was also an interesting debate on the part to be played by countrywomen in preserving the beauty of the countryside.

There was a large attendance at the meetings, at which a number of visitors were present as well as representatives of various organizations. Persons taking part in the Conference were privileged to receive the invitations extended to the delegates to the International Council of Women, and were therefore able to see something of conditions of life in Vienna.

It was decided to reconstitute the Liaison Committee of Rural Women's Organizations, which was instructed to publish a report of these proceedings and to make preparations for a further conference. It was also resolved that the informal alliance with the International Council of Women should be carried on, subject to the consent of that organization. These decisions were taken by members of the Conference voting in an individual and not a representative capacity. In order to ensure some financial support for secretarial and office expenses, those present were invited to give donations or promises on their own account or on behalf of societies with which they were connected. Upwards of £100 was promptly guaranteed, and there were indications that further assistance would be forthcoming.

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Rural Development

THE Sixteenth Annual Report of the Carnegie United Kingdom Trust, for the year ended December 31 last, states that the Trust, at the request of the Minister of Agriculture, has practically decided to co-operate further in the sphere of Rural Development by extending their help to the formation of Rural Community Councils and by helping the Young Farmers' Clubs movement. Encouragement of Rural Community Councils is, in fact, encouragement of Rural Industries, the development of which may do much to assist the economic welfare of workers in the countryside. The Councils also do what they can to improve the social amenities of the country dweller. It is probable that the Trust will set aside an allocation of £50,000 to assist in the

establishment of additional Rural Community Councils during the period 1931-35. The activities of the Rural Community Councils already established are fairly fully described in the Report; and it should not be forgotten that the Councils derive a substantial part of their incomes from the Development Fund.

The work of the National Council of Social Service during 1929, in connexion with Young Farmers' Clubs, has resulted in the formation of a National Association of Clubs and the publication of *The Young Farmer*. Nineteen new clubs were established last year and nine more were being formed when it closed. The National Council is convinced, from the experience of 1929, that the movement forms a unique means of quickening the interest of boys and girls in the life and work of the countryside.

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World's Grain Exhibition and Conference, Canada, 1932

AT a representative Conference held in Canada in 1928, at which the Dominion Government, the Provincial Governments, the City of Regina, the Regina Exhibition, and many of the more important business and financial institutions of that country were represented, it was decided to hold a World's Grain Exhibition and Conference. The desire to do so arose out of the unanimous opinion that some such effort should be made to bring together world authorities on agriculture, particularly those interested in field crops, and further to bring into open competition grain and other seed produced in different parts of the world. The Hon. Dr. W. R. Motherwell, speaking at the Conference, summed up the situation in the statement: "In holding such an event as a World's Grain Exhibition and Conference there are wonderful possibilities for stimulating interest in improving the quality of cereal crops, and in disseminating knowledge of how to improve agricultural conditions generally."

The Government of Canada has invited all countries to participate, and the importance of grain growing to the peoples of the world is something that would seem to warrant a spirit of optimism among those responsible for the organization of this international event.

In the Exhibition, competitive classes have been provided for cereals, grasses, clovers and vegetable seeds, which it is hoped will bring together the finest collection of these seeds

ever placed on exhibition. The prize list is generous, and in some classes allows for as many as fifty prizes. These classes will be supplemented by educational displays staged by the Dominion Government and Provincial Governments, and other countries are especially invited to stage displays of a similar character.

The Conference is of particular importance to the producers of crops and to research workers the world over. The greatest and best known experts from all countries will be gathered together for the purpose of giving their experiences and leading discussion. The good that may accrue from such a gathering cannot be over-estimated.

Ample accommodation will be provided for exhibits and Conference sessions; in addition, delegates and members will be privileged to see the Regina Exhibition, which covers all branches of agriculture, and, at a later date, the world-famous Canadian National Exhibition at Toronto.

The ultimate success of such an undertaking rests largely with the participants, and the Exhibition and Conference Executive will be pleased to supply all information to those who wish to co-operate. Applications for this information may be addressed either to the Canadian Government Offices, Canadian Building, Trafalgar Square, London, S.W.1, or direct to the Secretary, World's Grain Exhibition and Conference, Regina, Canada.

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Navel-Ill in Sucking Pigs

THE following note has been communicated by Mr. V. C. Fishwick, P.A.S.I., N.D.A., N.D.D., of the South-Eastern Agricultural College, Wye, Kent. During the past few months, post-mortem examinations of a number of sucking pigs that, according to the herdsman's report, had been killed by the mother lying upon them, have revealed the fact that the piglings were suffering from a bacterial disease. The piglings from two litters had navel-ill and, in the case of a third litter, there was an ulcerated condition of the mouth caused by the necrosis bacillus. These piglings had made normal growth for the first ten days of their life. In one pigling, the joints were swollen, but in the others there were no characteristic external symptoms, although some of the pigs, prior to being found dead, were observed to be unthrifty and showed a disinclination to suck. The organisms which cause navel-ill gain entry through the navel cord just

after birth, and Mr. Roberts, of the Veterinary Research Department, Wye College, suggests that a method of treatment similar to the one which is applied in the case of calves might give effective protection. The navel cord is first painted with a solution of iodine in methylated spirits. It is tied with string close to the pig's body and cut about one inch below the string. The cut surface is dressed with iodine and then coated with Stockholm tar.

The necrosis bacillus and other ubiquitous organisms can infect the pigling through any wound or abrasion. Upon many farms no bedding is put into the farrowing pens. If the pens are not littered the piglings are liable to damage themselves by rubbing against the hard floor, causing wounds through which these organisms can obtain an entry. To give protection against this type of organism, therefore, in addition to navel treatment, the farrowing pens should be kept well bedded down with clean short straw. These protective measures were put into operation in a herd where both navel-ill and the necrosis bacillus were known to be causing damage, and, to date, have apparently been effective.

* * * * * *

Register of Dairy Cattle

VOLUME XIII of the Register of Dairy Cattle, published last month, contains particulars of 7,500 cows selected on their milk yields during the year ended October 1, 1929. For a cow to be eligible for entry in the Register, its milk yield must not be less than the standard prescribed for its breed or type. The standard yields are as follows :—

Friesian	10,000 lb.
Ayrshire, Blue Albion, Lincoln Red Shorthorn, Red Poll, and Shorthorn ..	9,000 lb.
All other breeds or types	8,000 lb.

The number of entries in the Register was restricted to 7,500, which allowed for the inclusion of only 50 per cent. of the total number of cows eligible. Of the cows entered, 22 gave over 20,000 lb. of milk during the year ; 273 between 15,000 and 20,000 lb. ; 801 between 13,000 and 15,000 lb. ; and 2,979 between 11,000 and 13,000 lb., while 2,815 of the remaining 3,425 gave over 10,000 lb. Nineteen recognized breeds or types are represented in the volume, 55 per cent. being of the Shorthorn type, 22 per cent. Friesian and 5 per cent. Guernsey. A statement is given showing the number of cows of each breed eligible for entry in the Register, the number and distribution of the yields of the cows of each breed entered, and the lowest yields entered for the principal breeds.

A list of 291 cows in respect of which Certificates of Merit have been awarded is also included in the Register. To be normally eligible for a Certificate of Merit a cow must have calved not less than three times during a period of three consecutive milk-recording years, and have given during those years not less than the prescribed yield of milk, which for the three years ended October 1, 1929, was 30,000 lb. for Friesians, 27,000 lb. for Ayrshires, Blue Albions, Lincoln Red Shorthorns, Red Polls, and Shorthorns ; and 24,000 lb. for all other breeds or types.

Particulars are given of pedigree bulls of proved milking strain. The condition of entry of a bull in this Section of the Register is either (*a*) that its dam and sire's dam must have given the standard yield prescribed for their breed or type during a milk-recording year, or (*b*) that it has two or more daughters which have given not less than the standard yield prescribed for their breed or type in a milk-recording year. Entries relating to 153 bulls are given in the volume, 104 of which qualified under condition (*a*) and 49 under condition (*b*).

An up-to-date list of the Milk Recording Societies in England and Wales with particulars of each Society and the name and address of the Secretary, is included in the Register.

Dairy farmers and others desirous of acquiring pedigree or non-pedigree animals with authenticated milk records should find the Register a valuable book of reference.

The Register is priced 1s. post free, and can be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or through any bookseller. A copy of the volume is issued free to all members of Milk Recording Societies.

* * * * * *

Revision Course in Cheesemaking for Dairying Teachers

AT the Annual Conference of Dairy Instructors, held in London in October last, an opinion was expressed that it would serve a useful purpose if revision courses in cheesemaking were arranged from time to time. Acting on the resolution passed on that occasion, the Ministry has undertaken the organization of such periodical courses in order that the Instructors and Instructresses employed by the various educational authorities may have an opportunity of becoming

acquainted with the latest improvements in the manufacture of the principal varieties of cheese. It is probable that the courses will be arranged at intervals of three or four years.

Arrangements for the first course, which will be held at Reading during the week commencing September 22 next, are now being made, and the Ministry has secured the services of well-known demonstrators of the manufacture of the important types of cheese. The fee for the course will be three guineas, to include accommodation at one of the halls of residence at Reading University. The actual demonstrations and discussions will take place during the period July 23 to 26, at the British Dairy Institute. A circular letter has been issued to the County Education Authorities and to the Agricultural Colleges inviting the attendance of any Instructor or Instructress in their employ.

* * * * * *

Importation of Cherries

WITH the object of preventing the introduction of the Cherry Fruit Fly, the importation of cherries into England and Wales during the season of 1930 has, in accordance with the practice of the past few years, been restricted by an Order made under the Destructive Insects and Pests Acts, 1877 to 1927.

Cherries grown in France were allowed to enter without restrictions until June 3; after that date, cherries grown in the Southern Zone were prohibited; while those grown in the Central Zone were not admitted after June 9. It was originally proposed that cherries grown in the Northern Departments should be admitted until July 6, but the discovery, between June 12 and 19, of seriously infested consignments from those districts made it necessary to issue an amending Order prohibiting importation after June 24. No French cherries will now be admitted, except those grown within a small district in the neighbourhood of Honfleur. Details of the various Zones are given in the Order.

Cherries grown in Italy were prohibited after June 5, except those grown in the Region of Emilia, which were allowed to enter until June 16.

Cherries grown in any other European country, and imported after June 5, must be accompanied by certificates of origin.

* * * * * *

SOILING CROPS ON SMALL DAIRY HOLDINGS

I. Introduction.—An experiment designed to test the applicability to farming practice of certain results obtained at the Harper-Adams Agricultural College* on the soiling of dairy cows was undertaken by the Ministry of Agriculture in 1920. In the first instance the College demonstrated that dairy cows could be successfully maintained, indoors, throughout the summer, on a succession of arable forage crops. Moreover, the average yield of milk from the soiling crops was 500 gallons per acre as compared with 200 gallons from grass land.

The results were so promising that in the following year an intensified system of cropping was adopted with the object of feeding the cows, all the year round, on the produce of a limited area of arable land. Cabbages were planted behind the summer fodder crops, and were fed to cows during the winter with pea and oat hay. Mangolds and pea and oat hay completed the year's requirements. Thirteen cows consumed the produce of 7·2 acres of green fodder crops, 7·18 acres of pea and oat hay, and 1·1 acres of mangolds. In addition, cake was supplied throughout the year at the rate of 4 lb. per head per day. The cows kept in good condition, and the average yield of milk was 652 gallons per cow or 548 gallons per acre. As regards the bulky part of the ration, the standard allowance was about 80 lb. of green fodder daily. With this weight of cabbage cows consumed about 14 lb. of pea and oat hay.

It was pointed out that the success of the system depended greatly on feeding the crops while still young and succulent, thus indicating the importance of rich land so that a large bulk of forage might be obtained before maturation had gone too far. It was also considered important to regulate the diet in accordance with its wet or dry condition.

The College reports, written just after the war, claim definite advantages for the system in respect of land settlement, the employment of labour, increased output and so forth, but they specifically state that the soiling farm cannot compete with grass land in the production of cheap milk during the months of May and June.

Owing to the fact that this particular type of dairy farming

* Soiling of Milch Cows Experiment, by J. C. Brown: First Report, 1918; Second Report, 1919.

was almost unknown in England, especially on small holdings, the Ministry decided that, with certain modifications, it should be tried out at three centres, viz., Redhill Farm, Denham, Bucks; Whyburn Farm, Hucknall, Notts; and Resparveth Farm, Grampound Road, Cornwall. The holdings represented land rather below the average in quality, and dairy cows of ordinary commercial type were purchased to stock them. It was thought that these limitations would accord more or less with the normal conditions to be met with by the smallholder. The buildings essential to this type of farming had to be constructed, and so the first two years of the experiment did not produce results of any material value. The area of the farms was as follows: Denham, 44 acres; Hucknall, 48 acres; and Resparveth, 36 acres. Buildings necessary for 20 to 24 cows and corresponding young stock, together with a tower silo, were provided at each centre.

A small area of grass was retained on each of the holdings: at Denham, 11 acres; at Resparveth, 8 acres; and at Hucknall, 15 acres. The last-named holding at the outset consisted only of 30 acres with 3 acres of grass; later 18 acres were added making 48 acres altogether, with 15 acres of grass. Thus, during the summer a limited amount of pasturage was available, which was supplemented by forage crops as and when required. The remaining period of the year was to be covered by crops which had been grown and stored, such as oat and pea hay, silage and roots. Silage was also intended to serve as emergency fodder in summer, if required.

From the outset milk was practically the only commodity produced for sale.

From 1921 to 1925, the management of the farms was carried out by the Ministry of Agriculture. In 1925, the conduct of the experiment was transferred to the Agricultural Economics Research Institute at Oxford.

II. The Farms.—*Resparveth Farm* (Cornwall), on the Plymouth-Truro line, some eight miles from Truro, had the advantage of an early spring, a mild winter and generally a fair rainfall. Consequently, the initial advantages of a soiling system were considerable. The arable land consisted for the most part of medium loam, and the pasture land was distinctly good in quality. Lying well drained and dry, it produced early feed for cattle in the spring. Briefly, the whole farm

was easy to work and required little expenditure of labour on "overhead charges."

From the economic standpoint the farm suffered on account of its distance from markets and urban centres of population. The market for liquid milk is very much over-supplied except in the holiday months, when a large influx of visitors somewhat relieves the situation. Plymouth is the only large town in the district, but even here it was found extremely difficult to arrange a satisfactory contract. Consequently very low prices had to be accepted. Moreover, during the last year of the experiment considerable loss was experienced by a bad outbreak of contagious abortion in the herd.

Whyburn Farm (Hucknall, Notts) consisted of a variety of soils, from heavy clay to sour, almost infertile, sand. The grass land, with the exception of some laid down in 1926 and 1927 as a long ley, was almost valueless. The grazing which it provided for the cows was negligible and, after the middle of June, would not usually have maintained an animal in poor store condition. A small portion lying on the sandy hillside had long been given over to rabbits. In the later years the number of crop failures was high.

The climate at Hucknall is often severe, and all spring cultivations and sowings were generally two weeks to a month behind the other farms.

Economically the locality was not unfavourable, although the prolonged depression in the coal industry had tended to reduce prices. As the town of Hucknall was only about 1½ miles away, there was always an assured market for liquid milk, although contract prices proved to be very much lower than the London agreements.

Redhill Farm (Denham, Bucks) had the great advantage of proximity to the outskirts of the Metropolis, and the prices obtained were always appreciably in excess of the National Farmers' Union contract prices. The arable land consisted partly of gravel and partly of heavy loam and clay. The gravel area required heavy dressings of farmyard manure; it was very liable to dry out and set hard, thus delaying cultivations. The clay portion was very heavy to work, but produced average crops if winter sowing was early. The grass land, very wet in places owing to springs under the gravel cap, produced a remarkable flush of grass early in the spring, but after this had been grazed down there was little secondary growth, and towards the end of summer it provided little

or no keep. Six acres of the heavier arable land was laid down in 1927, and a very good ley was established. As a result of past neglect the hedges and ditches were expensive to keep in reasonable repair.

Owing to the great distances at which two of the farms lay from London in the first period (1921-25) and from Oxford in the second (1925 onward) only intermittent supervision was possible, and consequently the working out of the scheme had to be left largely to the foremen.

III. Summary of Results: (1) First Period, 1920-1925.—Although the work was begun as a demonstration it was soon realized that it must be regarded as experimental.

The rotation adopted on the farms at the outset was a three-course one; (*a*) soiling crops, (*b*) silage and roots, and (*c*) oat and pea hay. Later, this was modified to a four-course rotation, namely, (1) hay, (2) silage, (3) soiling crops, and (4) half silage and half roots. A time-table of soiling crops, usually vetch-cereal mixtures, was adopted, but the sequence was not maintained throughout the period of the experiment. One of the soiling crops, maize, was entirely abandoned. The silage crop was also varied somewhat, the most satisfactory mixture usually being one of vetches, beans and oats. The roots grown at the outset were mainly mangolds. Kale and cabbages, transplated, followed the soiling crops. Oat and pea hay constituted the whole of the hay crop during this period, and corn was not grown for grain and litter.

The stocking of each holding consisted of, approximately, 18 or 19 milking cows, one bull, and two horses. Young stock were reared for replenishing the herd, but the management varied throughout the experiment in this respect, owing to the difficulty of maintaining young stock in addition to the large milking herd.

The labour employed on the farms consisted in each case of a working overseer, with the necessary assistance. The overseer was to take his full share of the manual labour, to keep necessary records, and to direct other labour employed. He was to be paid, at the outset, £3 per week with free use of house and garden, and was to receive a share of profits (if any). The additional labour required was, for Denham, one man and one boy (in the year 1926-7 this was reduced to two boys); for Hucknall the overseer's wife and one man; and for Resparveth the overseer's son (later two sons) and his daughter for dairy assistance.

In measuring the economic results of the experiment, the method adopted from 1922 to 1925 was to take each arable crop from the time of sowing to the time of harvesting and carting, then to calculate the cost of the food value of such crop, and measure the value to the milk producer in terms of purchaseable foods (in accordance with the method recommended by the Departmental Committee on Rationing of Dairy Cows).

Measured by this method, the results of the silage, hay and mangold crops were satisfactory. The results of the soiling crops showed a very decided loss. The cost of production per ton of soiling crops, including delivery to the food house, was calculated at 33s., but the value per ton in terms of purchaseable foods was only 27s. 5d., making an average loss per ton of 5s. 7d., the equivalent, it was calculated, to a loss of 44s. 4½d. per acre. This loss was roughly the same on all three holdings on the three years' average used.

By the same method of calculation the silage crop showed a market profit. On the general average over the three years on all holdings, the cost per ton of silage was 24s. 7½d., while the value per ton in terms of purchaseable food was 35s., making a gain of 10s. 4½d. per ton by the use of silage and an average gain of 128s. 8d. per acre. The gain on silage was common to all holdings.

Similarly, the oat and pea hay crop showed a gain. On the average, the cost of production per ton of this crop, including delivery to food house, was calculated at 67s. 10d. while the value per ton in terms of purchaseable food was 108s., making a gain of 40s. 2d. per ton, or an average gain of 94s. 5d. per acre. Concentrates were used sparingly during the earlier years, chief reliance, both for maintenance and production, being placed on soiling crops. The result was disappointing as will be inferred from the average figures of milk yield obtained during the three years, 1922, 1923 and 1924, viz.: Denham 507 gallons, Hucknall 466 gallons and Resparveth 439 gallons. An increase in yield of approximately 75 per cent. would have been required to secure an income greater than the expenditure.

(2) Second Period, 1925-1929.—Under the management of the Agricultural Economics Research Institute, the approach to the ultimate economic result was shifted from the crop unit to the farm unit.

For the first two years, time sheets and accurate records for full cost accounting analysis were maintained, but sub-

sequently this form of analysing the results was discontinued. Owing to the very variable hours worked by the foremen, and the rapid changes from one job to another, any cost determination of individual crops or stock was considered to be misleading and a mere "paper statement." Moreover, since the saleable produce of the three holdings was practically entirely restricted to milk and milk by-products, it was considered that a direct financial analysis showed the annual position far more clearly.

(i) *Finance.*—In September, 1928, it was decided by the Ministry that the experiment should be discontinued, and as a result the farms were disposed of in the spring of 1929.

The accounts show that it is not in one item of expense but in practically all that this system has proved costly, and in no item does there appear to be an economy as compared with ordinary farming. The low yield, seldom in excess of 500 gallons, is very largely responsible for the high cost of milk produced, *e.g.*, 1s. 9d. to 2s. 4d. per gallon as compared with selling prices of 11¾d. at Resparveth up to 1s. 5¾d. at Denham (1925-1927).

PAYMENTS

(a) *Labour.*—The discussion of labour costs ought to be the fundamental question in small-holding economics; but, on these holdings, it cannot be made the final test for the simple reason that the holdings would not have shown a profit even if all the labour, including that of the overseer, had been done for no wages at all. How far an independent smallholder and his family, working for themselves, would have reduced the labour costs, is a question which this experiment cannot possibly answer.

(b) *Feeding Stuffs.*—The feeding of concentrates should bear a close relationship to the sales of milk, and under normal conditions this would be the case, but owing to abortion which broke out at Resparveth and Hucknall, milk sales dropped without relation to feeding costs. The assumption that soiling and silage crops would reduce cake bills was not borne out in these experiments, and a combination of a full concentrates ration and the costly arable land crops was bound to be excessively expensive.

In effect, the amount of concentrates fed worked out at practically a full allowance for every gallon of milk produced. That the grass, hay, silage, soiling and root crops have had only a maintenance value is a result that cannot be accepted by the farming community. Normally, the only justification, if any, for such a policy is a "milk and feed" system, and this was not adopted to any appreciable extent on these holdings.

The explanation may perhaps lie in the peculiar circumstances of the experiment—running on stale pasture, coupled with irregularity in the supply, and variation in the quality, of the various forages, according as they were consumed in a young and succulent or relatively mature and fibrous condition. At best such forage contains rather less protein and is less digestible than fresh green grass, but one would not expect it to be incapable of producing any milk at all.

(c) *Seeds and Fertilizers.*—The seed bill is bound to be high in this system of management. Similarly, artificial manures at 20s. to 30s. per acre of arable land constitute a heavy item. This expenditure was necessary, first, because of the system of intensive cropping and, second, because of the nature of the soil, which, being rather below the average in quality, constantly required large applications of manure to maintain its condition. In 1927-8 a definite experiment was made to dispense with artificial manures altogether. It did not, however, prove successful and could only be justified on the assumption of accumulated fertility from the heavy manuring undertaken in the two previous years. It may be added that each farm was equipped with a liquid manure tank, the contents being applied with good effect to the seeds-ley, and occasionally to root crops.

(d) *Miscellaneous Expenses.*—These represent a very large sum, which it is difficult to analyse in detail. One considerable item is the cost of silage making, which is discussed later when dealing with the individual crops.

RECEIPTS

Turning to the receipts, apart from the sales of cattle, the sale of milk was almost the sole source of income. This being the case, the two most important problems to be considered were the yield of the cows and the available market for liquid milk.

The milk yields (400 to 550 gallons) per cow were low on all of the holdings, and this fact can be assigned to several causes. One was the purchase of low-priced moderate-yielding cows. The area and productivity of these three farms imposed definite limits on the total head of stock which could be carried, and the only possible method of increasing the milk output was to increase the yield, not the size of the milking herd. An attempt was made from 1925 to 1927 to do this by purchasing, at commercial prices, old high-yielding cows, but owing to the considerable capital depreciation which this system involved the practice was discontinued.

Other causes of low yields were the direct effects of the feeding of the soiling crops, and the devastating effects of contagious abortion which was rife both at Resparveth and Hucknall. At Denham the farm remained free from infection until the last year of the experiment, and the output of milk was practically constant.

It was the intention at first to grade up the herd by rearing. As time went on, however, it was found impossible to maintain the heavy stocking necessary and simultaneously to rear young cattle. Consequently, under the final management, considerable sales and purchases took place. Barren and unproductive stock were replaced by young freshly-calved cows.

(ii) *Crops and Cropping.*—The economic difficulties of soiling have been well revealed. The system requires cultivation in very small plots, and the costs are high. Moreover, a greater degree of forethought and adaptation is demanded than in normal farming practice. A failure, or shortage of any one crop has a disproportionately serious effect in that the reserve pasture is not sufficient to maintain the herd until the next field crop is available for use. It was necessary, on these holdings, to keep a stock of provender in hand to meet emergencies. During the spring of 1928, both hay and silage ran out, owing to the low yield of 1927, and hay had

to be bought at a very high price. The months of March, April and September presented the greatest difficulties from the point of view of feeding.

The earliest date of spring cutting varied as much as six weeks, and certain crop sequences, in spite of the difference in the sowing dates, matured at the same time. Yet it was essential to the success of the system that the periods of cutting should work correctly to the calculated periods. When a complete break occurred in the soiling crop sequence, feeding stuffs had to be purchased to make good the deficiency, and there was always the uncertainty of yield.

These soiling crops can be used profitably for one purpose, and one only. There is no market to fall back on for the disposal of the surplus, and this uncertainty of time and quantity constitutes a great weakness in the application of the soiling system to small holdings. Ensilage, as applied to small surpluses, was considered impracticable for reasons that will be apparent later.

Silage proved the most useful form of home-grown food, producing as a normal rule yields estimated at over 11 tons per acre. The effect of feeding it to the stock, both as regards general condition and milk yield, was favourable; but in spite of its many advantages there were distinct difficulties in harvesting on farms of such small area. To work the cutter and blower, a tractor had to be hired at prohibitive cost; and since hiring was by the day, the tractor had to be kept working the whole time, this necessitating the employment of extra men and a third horse and cart.

As a tractor was not always available when required, much of the silage was greatly reduced in value because the crops had to be cut when over-ripe.

The provision of a silo, together with a cutter and blower, could seldom, if ever, be justified economically on a small holding.

Marrow Stem Kale proved a reliable crop on all three holdings, and provided a valuable food, particularly for late autumn and early winter.

Mangolds were the only other root crop grown regularly on all farms. *Swedes* were tried, and also small areas of *cabbage*, but both with insufficient success to be introduced as a normal part of the cropping schedule. *Catch crops* were frequently sown after rye, oats and tares or other early soiling crops, though, owing to the lateness in sowing, the yield was never very large.

Potatoes were grown with success on the Nottinghamshire and Cornish holdings, but the soil of the Middlesex farm proved unsuitable for the crop. Until some oats were grown the clamping of the roots was difficult and entailed the purchase of straw.

Lucerne growing was attempted at Hucknall and Denham in 1926 to supplement rotational soiling crops. Inoculated seed was used but did not prove successful, probably owing in part to the wet winter of 1927-8 and severe frost in 1928-9, which finally killed the last two remaining acres on the Hucknall farm. In view of the great risk of failure of one or more of the rotation soiling crops and the insufficiency of grass for tiding cattle over the affected period, lucerne, if it could

be successfully established, would form an invaluable insurance against such failure. In normal practice two or three crops such as mangolds, silage and lucerne will generally provide all the supplementary summer keep required.

Hay proved a serious problem, as it was always difficult to make it in sufficient quantity and to buy small lots of hay during the winter was very expensive. In order to alleviate this situation, additional areas of permanent grass were laid down at all three farms in 1926 and 1927. The extra hay thus obtained proved a great assistance financially, both by reducing hay purchases and by increasing the grazing area, thus establishing more insurance against soiling crop shortages and failures. Silage certainly reduced the hay requirements of the herd to a very great extent, but it did not replace it entirely. The sowing of one-year leys of "seeds" to increase the amount of hay was not attempted to any extent until the last year of the experiment. Pure Italian rye grass was tried in 1926 and 1927, but the hay which resulted was low in yield and poor in quality, for which there was little compensation in the small saving effected in the cost of seed.

Oat and Pea Hay was a normal crop in the rotation, but besides forming a coarse fodder it was exceedingly difficult to "make" in wet and sunless summers. Of all the crops grown on the holdings this one met with the most adverse opinion of the foremen. There can be little doubt that it is less suitable for milk production than meadow and seeds hay.

Corn Crops were not grown until 1926, and the consequent lack of litter and the shortage of dung were serious objections to the soiling system. Both Hucknall and Redhill farms were very much in need of organic manure, which no amount of artificials could supply, and on these grounds alone the production of straw was of considerable importance, quite apart from economies gained by maintaining the horses out of home-grown foods.

Owing to the large variety of crops and the number of sowings the farms became split up into numerous plots resembling allotment holdings. Consequently expenses of cultivation were increased and rotations became extremely involved. Small plots meant not only loss of time in working but also reduced yields owing to so many "outsides."

(iii) *Herd Management.*—The vexed question of whether to rear cattle with which to replenish the herds, so using food which might be converted into milk, or to purchase full profit animals and risk disease and capital depreciation, was decided variously at different times.

At first, stock rearing was attempted on the Redhill and Resparveth farms, but owing to the shortage of food it was found necessary—in 1927—to summer the young stock away, which proved a very costly undertaking. Subsequently the young stock were gradually disposed of and all calves were sold at three days old.

The purchase of cows as required on the open market entailed grave risks of disease. A considerable falling off in the milk yields in the last three years of the experiment is almost entirely accounted for, at Resparveth and Hucknall, by serious outbreaks of contagious abortion. At Resparveth, in

1927, over 50 per cent. of the cattle actually aborted, and it became increasingly difficult to get cows and heifers in calf. At Hucknall fewer cattle actually aborted, but it became quite impossible for over 12 months to get any cows in calf, in spite of veterinary advice and assistance. At Redhill, one or two cases of slipped calves occurred during the last two years.

It would be almost impossible to calculate in figures the gross loss which resulted. Apart from the direct loss by the cows not coming into profit and by being hard to get into calf, account must be taken of capital expended on buying new cows and of the difficulty of disposing of the non-productive animals at anything approaching a reasonable price.

The problem of contagious abortion may not appear very relevant to a report on soiling systems, but it was of the utmost importance on these small holdings, where only a restricted area of pasture, which quickly became tainted, was available.

The *feeding* of the dairy herd in summer was largely dictated by the yield of the soiling crops, and to attempt to give typical rations would only be misleading. Experience proved on each holding which were the most suitable crops, and it is impossible to lay down a hard and fast rule. The number of animals on the holdings could not be continually altered to fit in with the available home-grown food supply, and shortages had to be made up by grass, where possible, or more frequently by cutting some of the silage crop for soiling.

In winter, additional supplies of hay had sometimes to be purchased. It has been suggested that the effect of feeding soiling crops was definitely to lower the milk yield. This certainly seems to be indicated, but the fact that freshly-calved high-yielding cows fell off rapidly when soiling crops were fed, and recovered again when silage, hay and roots were given, suggests that factors other than bulk—such as the state of maturity of the soiling crop and the improvisations adopted to make up for shortages—may have been at least partly responsible. A Leeds experiment showed that the effect varied according to the soiling crop in the sequence, and that some mixtures seemed to stimulate milk yield and others to depress it. That, however, is a matter which could be better tested under semi-laboratory conditions than under the conditions existing on these holdings. The fact remains that in ordinary practice the provision of supplementary

succulent green keep is a commonly recognized means of maintaining the milk yield when grass begins to dry up or lose its freshness.

In the absence of straw for litter, trial was made of peat moss, but there are many serious drawbacks to its use and the manure which it makes is not nearly so beneficial as that from straw. Unlittered concrete floors were very productive of chills, and the purchase of straw was an extremely costly undertaking, particularly at Resparveth and Redhill.

IV. Machinery and Labour.—Implements that are satisfactorily adapted for small scale operations are not generally available; consequently ordinary farm equipment was used and the capital investment was abnormally high. The most costly single operation was the cutting and blowing of silage. The power needed for this operation was considerable—about 15 h.p. at least—but apart from this operation there was no other work on which such a power unit could economically be employed. Some cheaper form of power would have to be available on holdings of this nature before silage could be made economically.

Owing to the number and variety of croppings the time of the workmen was fully occupied and well distributed throughout most of the year. Only at hay-time and at silage harvest was it found necessary to increase the staff, although in some years assistance was obtained in setting out the mangold crop.

V. Conclusions.—In general, the lessons that emerge are largely negative and serve to confirm established practice. The soiling system of milk production *adopted on these three holdings* has proved financially unprofitable. That it enables more labour to be employed and an increased number of stock to be carried per unit of land is meaningless without reference to cost. If, by the system of grass management, it is only possible to maintain one cow to 4 or 5 acres, whereas, by a soiling system, one cow can be maintained on 2 or 2½ acres, the saving is the cost of the extra amount of grass land. This saving is, therefore, only the rent of three acres of grass per cow, and where the rent of such land is about 30s. per acre the saving is equivalent to £4 10s. 0d. per cow, or, in the case of these herds, of 1·86d. per gallon of milk. The extra expense in labour, seeds and manures required for the soiling system, therefore, which can be profitably incurred is limited to within

that figure of £4 10s. 0d. per cow. It appears from this experiment, at least, that the cost of an intensive soiling system is very much in excess of the grass system. (The cultivation of special forage crops wherewith to supplement summer pasture, as in ordinary practice, is another story.) It must be remembered, however, in criticising the system, that the Harper-Adams soiling experiments on which these farm tests were based were made in 1918 and 1919, at a time when increased production was demanded without regard to cost. The price of milk when the results of the Harper-Adams College experiments were published was about 3s. per gallon, and even when the experiment now under review was started in 1920 that price was still ruling for milk. The price of milk, however, had dropped by 1922 to about 1s. 6d. per gallon for winter milk, and later to about 1s. 4d. per gallon for winter supplies and 1s. for summer supplies.

No single reason can be given for failure, but the most important factor was the smallness of the area. On a small farm every failure of a crop, every disease or death of an animal, every error of judgment is magnified out of all proportion compared with a larger farm. Accurate time-table cropping proved impossible as a small-holding policy.

Other difficulties were the low average milk yield and the poor prices obtained for unproductive cows. For this state of affairs the purchase and retention of old cows and outbreaks of abortion were largely responsible. As rearing is impracticable the only policy to pursue in the circumstances would seem to be the purchase of heifers in milk, and the disposal of them later fat, as young cow beef.

Further, there is little doubt that soiling crops do not, in fact, completely replace fresh green grass for milk production. Yields are not maintained and the expenses in production by arable cropping bear no comparison with production by natural grass. The shortage of hay and litter, which under the system is inevitable, are other important drawbacks.

The available market for milk has likewise a material bearing upon the system, and in this matter the Cornish holding suffered in comparison with the others.

Finally, it can be said that the financial failure was due largely to the smallness of the sales. Some economies could undoubtedly have been effected by closer supervision, but the largest items of expenditure, wages and artificial foods, could not have been altered to any great extent. The only possible way to have covered and more than covered the outgoings was to have increased the output.

One more point: there can be little real comparison between the man and his family working for themselves, bearing the full capital risk of the enterprise, and the man working without risk on a sound wage. It may, therefore, be of interest to record that the foreman on one of the three holdings (Resparveth) has leased the farm as tenant under the County Council. After nine years of experience of the system, it will be interesting to note what modifications and alterations are brought about by the man whose sole object is to make a living for himself and his family. Arrangements have been made whereby the Institute at Oxford will be enabled to observe the system which he follows, and the success or failure with which it meets. At the same time, the Institute, in collaboration with the County Agricultural Staff, will endeavour to obtain from as many farmers as possible in certain typical districts in Cheshire further information as to the best proportion of arable land in a dairy holding solely from the point of view of profit to the holder.

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FIFTY YEARS OF THE POULTRY INDUSTRY

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To Oliver Cromwell is attributed the statement that "he goes farthest who knows not whither he goes." The Great Protector realized that we seldom visualize where the path on which we enter will lead us. No one in the later decades of the last, or in the earlier years of the present, century anticipated the position that would be held by poultry husbandry in 1930. That a World's Poultry Congress would assemble in the Capital of the Empire upon the invitation, and under the direct control and responsibility, of the British Government was never contemplated. Twenty years ago the poultry industry was regarded as the Cinderella of the agricultural world, thus implying the general attitude adopted towards those engaged in the production of this branch of home food supplies. To this, however, Ireland was the one exception: the importance of poultry production was recognized in that country forty years ago. Energetic steps had been taken to stimulate its development, both in methods and extent, with remarkable results. In 1887, the writer undertook an exhaustive inquiry into the subject in Ireland, and this

contributed to the action taken by the Department of Agriculture which was set up later. At the date of the inquiry, the annual value of Irish eggs and poultry exported was about £1,500,000. By 1929, it had increased to a value of nearly £6,500,000.

From the mid-years of the nineteenth century, during the period known as that of the Cochin Mania, specialized breeding of poultry became a feature of British country life. Its object was then mainly exhibition, and so continued for half a century. Food production was a minor consideration. In a few districts, however, there were exceptions, notably table chickens in south-eastern England, ducks in Buckinghamshire and the adjacent counties, turkeys and geese in East Anglia, and geese in Cumberland. Otherwise, and as far as public authorities, landowners and farmers were concerned, there was a general opinion that poultry could not be looked upon as profitable stock; they were regarded as merely a side line to provide farmers' wives with pocket money, and to supply their household requirements. They were also a source of pleasure to exhibitors and amateurs, or were bred by cottagers and urban residents of the same class. Throughout the years when exhibition breeding was dominant, there were but few who visualized the possibilities of a greatly extended and profitable industry. Some of these attempted production on a commercial basis, but for various reasons failed to achieve success.

Notable among these reasons were bad methods of housing and management, the keeping of breeds of comparatively small average production, the low prices obtainable at that time for the produce, and unsatisfactory marketing. Eggs were a surplus product, unreliable in supply; and the same was true of the general type of fowl. Ducks were a luxury food, as they still are. Geese and turkeys were seasonable supplies and, therefore, limited in consumption.

By the year 1880, however, a changed outlook had become evident. Although concentration by exhibition breeders upon abnormal points had resulted in minimizing the productivity in eggs and flesh of the most popular breeds, the introduction of more economic races of fowls had shown that the relative output could be greatly increased without a corresponding addition to the costs. The margin between costs and returns was widened. Increasing prosperity of our people, and changes in habits of life, were leading to a greater consumption of eggs, stimulated by rapid increase of imported supplies. Better methods were making for greater success. Education was

stimulating imagination. The time of economic prices had not, however, been reached.

Looking back over the half century, culminating in this Congress year, we may well wonder at the creation of a great national industry through the humble hen. The advance made between 1880 and 1930 can be gauged to a considerable extent by statistics, although official figures are lacking in regard to poultry population and production in the earlier years; and the altered status of the Irish Free State territory necessitates some adjustment of recent production figures to arrive at a comparable basis. For 1880, we may take an estimate of production in the British Isles, made in that year by the late James Howard, of Bedford, who arrived at the conclusion that the output of eggs and poultry had reached a total value of £5,000,000. Official estimates of recent output are as follows:—

	Eggs		*Poultry*		*Total*
	Year	£	Year	£	£
England & Wales.	1928*	11,520,000	1928–29	5,380,000	16,900,000
Scotland	1928–29*	1,620,000	1928–29	660,000	2,280,000
Northern Ireland.	1928	2,543,000	1927–28	869,000	3,412,000
Irish Free State.	1926–27	6,690,000	1926–27	2,327,000	9,017,000
		22,373,000		9,236,000	31,609,000
* Exclusive of production from other than agricultural holdings (1 acre and over). From other than agricultural holdings, the production may be estimated very roughly at—For England and Wales..				4,150,000	
" Scotland				400,000	4,550,000
					£36,159,000

These figures do not accord with my own estimate of production in Britain. In England and Wales, as also in Southern Scotland, the realized prices for eggs are higher than the ordinary market returns indicate, owing, over wide areas, to the proximity of producers to retailers and consumers—so that maximum prices are obtained while expenses are at the minimum. To avoid any appearance of exaggeration, however, these statistics are included in preference to my own. They indicate, nevertheless, how great has been the advance.

On the basis of these figures, the increase in total production values in the British Isles at the present day compared with 1880 is, approximately, £31,159,000 or 623 per cent. If Mr.

Howard's figures referred only to poultry on farms, as may be accepted although not stated, the advance, approximately, would be 532 per cent.

The growth of imports during the same period has been enormous. Comparison cannot be given exactly because, in 1880, eggs from the Irish Free State territory were not included in the import returns, nor are official figures available for that year of imports of dried and liquid eggs, in which forms the importation of eggs increased greatly during the War, and has since been maintained. Imports of eggs in shell into the British Isles in 1880 totalled 6,228,405 great hundreds, of the value of £2,235,451. Assuming, for comparison with 1929, an additional £500,000 as the value of eggs sent from Irish Free State territory to other parts of the British Isles, and for imports of eggs not in shell, we get a total import figure for the United Kingdom of £2,735,451 in 1880. The comparable figure for imports (all countries) in 1929 includes, eggs in shell £17,855,625, and eggs not in shell £3,683,350—a total of £21,538,975, or an increase of 687 per cent.

In 1880, the average declared value of imported eggs was 7s. 2d., and in 1929 (omitting those from the Irish Free State) 14s. 6¾d. per great hundred, an advance of 103·2 per cent.

As far as the countries enumerated are concerned, eggs from southern Russia, Austria-Hungary, etc., were formerly largely credited to Germany as the country of final shipment, and those from Italy to Belgium. Thus the records between the two periods are not comparable. The following table gives particulars as to some other sources of supply :—

Quantities of Eggs Imported into the United Kingdom (Great Hundreds)

	1880		1929		
	Total	Per cent. of gross total	Total	Per cent. of gross total*	Per cent. increase or decrease
Denmark ..	409,694	6·6	5,573,841	22·3	1,260·5 inc.
Netherlands	182,637	2·9	3,162,487	12·7	1,631·6 inc.
France ..	3,151,158	50·6	867,799	3·5	72·5 dec.

* Note : This total includes imports from the Irish Free State.

Declared Values of Eggs Imported per Great Hundred

Denmark	5s. 9d.	16s. 10¼d.	193·1 inc.
Netherlands	8s. 1¼d.	15s. 10½d.	95·9 inc.
France	8s. 1d.	15s. 0¼d.	85·8 inc.

With regard to table poultry, imports in 1880 were not recorded separately but were included with game and rabbits the gross value of which was £421,645. Assuming that poultry

were in value £200,000, and deducting Irish Free State supplies in 1929, the increase was, therefore, £2,027,739, or 1,014 per cent.

The value of eggs and poultry consumed in the United Kingdom in 1880, inclusive of native and imported supplies, was estimated to be £7,435,000. No official figures are available. In 1929, the net imports of eggs (including eggs not in shell) and poultry amounted to £24,141,459, less £179,685 (representing exports and re-exports of poultry) or a total of £23,961,774. Adding home production as previously shown (£36,159,000 less the Irish Free State £9,017,000), *i.e.*, £27,142,000, we get an approximate present consumption figure in the United Kingdom of £51,000,000, or an increase of just under 590 per cent. Of this total of £51,000,000, some £19·7 millions represent imports from countries other than the Irish Free State, or 39 per cent. of the whole.

As shown above, the increase in average values of imported eggs in 1929, compared with 1880, was 103·2 per cent. As a result of considerable improvement in quality, it may be assumed that home produce advanced in value during the same period to a greater degree. On the other hand, imports, omitting those from the Irish Free State, had increased in quantity by 220 per cent. That home production has made equal, if not greater, progress in the fifty years is evident. The signs are seen in every part of Britain, in some areas more than others. The returns for 1929, not yet published, show a considerable advance over 1928. Lancashire is the premier county for poultry production, with 309 adult fowls per hundred acres of cultivated land, followed by the West Riding of Yorkshire (120), Cheshire (117) and Cornwall (107), ranging down to 31 per hundred acres in Northumberland. The average in England is 81 per 100 acres, and in Wales, 68, varying from 91 in Flint to 45 in Radnor. Scotland, where the average is 84·5 fowls per 100 acres of cultivated land, varies from 230·7 in the Isle of Orkney, 132·4 in Ayr, and 113·4 in Renfrew, to 35 in Berwickshire. (These figures are exclusive of computations relating to poultry on holdings of less than one acre in England and Wales, and in urban areas, and do not include poultry other than fowls.)

Much of the advance made is due to the remarkable development of commercial poultry husbandry, that is, of egg farming. Considerable progress had been made prior to 1914 ; and, since the War, the advance in all parts of the country has been phenomenal, mainly in those areas which are contiguous to

the great centres of population. Where farmers have included poultry among their stock, and conducted the operations on business lines, they have proved poultry to be profitable. As a consequence, considerable extension is taking place in this direction. Although belated, this should become of great importance to the national food supply, and provide for a large increase of average consumption of eggs and poultry, which is much below that of some other countries.

The changes and developments briefly summarized above are the result of many and varied influences. Among these have been the educational activities of Colleges and County Councils, assisted by State grants; individual example and advocacy; the work of poultry and other societies; and the press. Early in the 'eighties of last century, many of our leading journals opened their columns to writers who called attention to neglected opportunities, in this way reaching the great mass of people, and creating a public opinion which, in turn, made a demand for concerted action not to be denied.

In 1880, no one anticipated that what we now know as egg farming would attain its present proportions. At that date, table poultry appeared to present the greater opportunity for profitable production. In 1879 and 1880, the Birmingham, Dairy and Oxford Shows inaugurated classes for dead poultry, followed, in 1894, by the Smithfield Fat Stock Show, the last-named due to the enterprise and generosity of the late Sir Walter Gilbey. At the Birmingham Shows of 1883 and 1884, classes were instituted for preserved eggs, creating great interest. Apart from poultry shows, the rising interest in this class of live stock was indicated by classes at agricultural exhibitions. The Bath and West of England and the Highland and Agricultural Society of Scotland had previously instituted such classes; but it was not until 1885 that the Royal Agricultural Society of England made its annual show more complete by the introduction of a poultry section. Later, it rendered a notable service by arranging demonstrations in fattening, dressing and trussing of poultry.

Great and manifold have been the inventions and modifications of equipment and management. One of the most notable was the introduction of the Hearson Incubator in 1882, which made artificial hatching practical and economical. It effected a revolution in the industry, one of the most fundamental in its history.

For the next decade, there was a constant and ever-growing conflict between the divergent ideals of exhibitors and pro-

ducers, the latter being stimulated by increase of imports, and especially by reports of what was taking place in Denmark and Ireland. The rise and success of breeding farms for the supply of productive stock helped greatly. Gradually, it became evident that ultra-exhibition methods were losing ground.

Up to the 'nineties of last century, with the exception of information, statistics and sympathetic encouragement, no direct help was given by central and local authorities, or agricultural colleges, towards the extension and improvement of egg and poultry production. In 1891, Parliament made a grant of £800,000 per annum to county councils, primarily for teaching in technical and vocational subjects. The following year was notable for the commencement of systematic instruction by lectures, classes, and demonstrations by which all classes of the community could be influenced. This system has since been extended to cover the whole country, and enlarged in various directions from time to time. There was thus awakened a realization of opportunities and potentialities. A demand was created for advanced education and research in the subject, and this led to the adoption, in 1922, of the National Poultry Institute Scheme. Meanwhile, there was another movement which resulted in the inclusion of poultry husbandry in the curricula of colleges and farm schools.

A few only of the leading stages of this latter development need be mentioned. The first poultry school, extending over three weeks, was held at Whittlesea, Cambs., in 1893. In the same year, courses of instruction were commenced at the (then) University College, Reading, for special and agricultural students; and, in 1898, the College poultry farm was established at Theale, Berks. Both of these continued until 1910. In 1894 the (then) Board of Agriculture included lectures upon poultry at a class for county dairy teachers held at Leeds University. The following year, poultry instruction became a feature at the Lancashire County Council farm at Hutton, Preston. The year 1897 saw the first laying trials, organized by the (then) Utility Poultry Club; similar trials are now universal, and have contributed powerfully to the extension of the poultry industry in all parts of the world. In 1908, the late Lord Pentland, then Capt. John Sinclair, Secretary of State for Scotland, appointed a Departmental Committee, whose report laid the foundations of the remarkable advance which has characterized the development of poultry breeding and production in the northern part of the kingdom. In 1920, the National Poultry Council was instituted, and this has become the Clearing House of

those engaged in poultry husbandry. Finally, the Ministry of Agriculture and Fisheries, in 1923, appointed a Poultry Commissioner as one of its permanent officials; and, in 1925, it formed a Markets Division, which has undertaken responsibility for the better organization for sale of eggs and poultry, as well as other produce.

* * * * * *

IMPERIAL BUREAU OF FRUIT PRODUCTION

(EAST MALLING, KENT.)

R. G. HATTON, M.A.,

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ALTHOUGH the well-known recommendations made at the Imperial Agricultural Conference in 1927 form the foundations upon which all the new Bureaux are building, this does not necessarily imply a complete uniformity of growth and method. The early progress of some of the larger Bureaux has previously been chronicled.* They already possess a considerable clientèle of specialized investigators, scattered throughout the Empire, with whom it is immediately possible to agree upon common bases of technique as a means of exchanging information and elaborating certain common principles.

The small gathering of investigators who, in 1927, expressed the desire for an exchange of information on matters concerning fruit production was as varied in its composition as the official title of the resulting Bureau is comprehensive. Whilst the primary preoccupation of one Dominion had been the breeding and selection of fruit plants suitable to its particular climatic conditions, that of others was the conservation, storage and transport of an all too plentiful fruit harvest. Again, the production of high quality produce, through a more perfect economic control of diseases and pests, was the foremost problem of one group of investigators, whilst the possible application to tropical crops of the broad principles involved in deciduous fruit-growing was interesting the representatives from many Crown Colonies.

Meanwhile, at a comparatively recent date, there had grown up in this country of highly developed fruit culture a programme of intensive research upon the nature and responses of the fruit plant, and the functioning of its constituent parts, under given conditions.

* For previous articles of this series in this JOURNAL see *Imperial Agricultural Bureaux* (August, 1929, p. 461); *The Imperial Soil Bureau* (January, 1930, p. 925); *Imperial Bureau of Animal Genetics* (March, 1930, p. 1149); *Imperial Bureau of Animal Nutrition* (June, 1930, p. 219).

The Bureau's first task was to draw up an index of research being carried out in different parts of the Empire. The replies to the circular letter sent out have shown that, where research has been initiated at all, it was generally only in its infancy, and that a good deal of uncertainty exists as to its exact aims, the actual lay-out of experiments and the drawing of conclusions therefrom.

True, there had previously been the pioneer work of Bedford and Pickering within the Empire, and this has at any rate taught the lesson that horticultural traditions cannot be taken for granted, and that critical examination thereof is urgently needed. These explorers, however, necessarily left so many issues clouded and confused that the fruit of their effort was rather in the nature of a valuable warning than of direct encouragement. Attention has therefore been mainly directed to the United States of America, where a large body of workers, with ample facilities, have turned their energies to investigations on various aspects of fruit production. Even here, actual achievement in the field of practical deduction has been meagre, to say the least, in comparison with the effort expended. One of America's most distinguished pomologists, who possesses an almost unrivalled knowledge of the practical and scientific problems involved both in the Eastern and Western States, reviewing the results of field experiment in the past twenty years, says :—

"The field experiments, however, have not yielded as valuable results as was expected of them. With soils that before the experiment started seemed to be uniform, there were often found variations that greatly influenced the behaviour of the trees; and other influences such as variations in the rootstocks used and the different kinds of injuries to the trees increased the experimental error,"

and again :—

". . . whilst the results of field experiments have been disappointing some rather valuable information has been obtained," yet, "Orchard spraying trials usually have given much more conclusive results than have trials of other orchard practices" (W. H. Chandler, *North American Orchards*. Lea and Febiger, Philadelphia, 1928: pp. 185-189). Later he emphasizes that the scientist in his laboratory "was never able from laboratory studies alone to determine with certainty what the best method of preventing injury in the orchard would be," and that "while fundamental knowledge of plants and soil is very helpful in planning experimental study of

practical problems, it seldom, if ever, answers directly the questions of practice."

The question at once arises as to what is the cause of this comparative failure in the past both in England and America to obtain concrete results, even from the simplest investigations into elementary principles. Was it due to the inherent variability of the plant material in use, and, if so, could that variability be reduced in any way—say by a more intimate study of the individual? Was it due to the use of a faulty technique of experimentation, or to the misinterpretation of the results?

There is considerable evidence to suggest that all these and other factors have been at work, since, within the past fifteen or twenty years, a closer attention to such details as the use of controlled material and an intensive study of the individual plant as an index have resulted in a respectable harvest of information. For example, they have yielded strikingly significant results, of wide application in the field, in the spheres of rootstock, pruning, manuring, and other cultural operations, as well as in the scientific utilization and treatment of the final product through vintage and storage processes.

It was obvious, therefore, from the first, that the initial work of the Bureau of Fruit Production would have to be the collection of information covering a very wide field and its circulation to workers of very different types and training. It must, therefore, aim at establishing common points of contact between these diverse interests, at building up a more or less common terminology, and at providing the means of reaching agreement as to a standardized technique, in order to develop fruit research and facilitate intercommunication thereon.

If such an attempt were not to become desultory, and fail through the immensity of the task, it was deemed necessary to bring under review the available information bearing upon the main practices of fruit production one by one, starting with the plant material itself as used by the horticulturist.

The fruit plant's identification, selection, propagation, and standardization, and the whole question of stock scion relationships in general are, in the first instance, being brought under review. Not only does the entire technique of field experimentation and of plot planning depend upon this basic knowledge, but, as the physiological botanist, the biochemist and the plant pathologist have come to realize, such exact data are equally necessary for an accurate study

of the functioning of the various parts of the plant, its response to different treatments, and its resistance to certain diseases. Evidence is to hand that investigators dealing with fruit and kindred crops, throughout the Empire, are still facing these initial problems, whether in deciduous or tropical fruits, in plants growing on their own roots (either from seed or from some form of layer) or in budded or grafted subjects. The ground had already been generally explored by the circulation of the memorandum on "The Standardization of Horticultural Material with special reference to Rootstocks" under the auspices of the Empire Marketing Board. It was therefore resolved by the Bureau to follow up in detail the general evidence already so obtained, and, as a result of the proportion of inquiries with regard to the position of such crops as rubber, coffee, tea and cocoa, it was agreed to include these in the scope of the survey. Much material has already been collected for the circulation of a detailed memorandum along these lines in the near future.

Once the existing knowledge concerning the horticulturist's material has been brought together, it is proposed to deal similarly, one by one, with the external factors which influence it, such as soil and climatic conditions, and orchard practices, such as pruning, manuring and methods of cultivation. Thus the field of the Bureau is so broad that it must necessarily seek and rely upon the co-operation of kindred institutions, and be equally ready to put its resources at their disposal. Such support has already been promised and freely given, especially by the University of Bristol Horticultural and Agricultural Research Station, Long Ashton, by the Royal Botanic Gardens, Kew, where tropical crops are concerned, and by the staff of the Low Temperature Research Station, Cambridge, where questions of fruit storage and transport are involved. In its initial stages, the Bureau of Fruit Production has been asked to embrace a wide range of subjects, some of which might well require more specialized attention at a later date. Should such occasion arise the Bureau will gladly pass on any data collected.

Whilst the Bureau is accumulating data for the series of memoranda foreshadowed, it is handling and sifting out a considerable amount of past literature and trying to keep pace with current periodicals bearing on fruit production. In this way, useful bibliographies upon particular subjects are already accumulating. Incidentally, the Bureau officers have been kept busy indexing the available literature on the Brussels decimal

system, since no special library staff is available. The system has proved well worth while for so wide a subject. It is hoped before very long to be able to summarize the most important papers from current journals and to circulate these periodically, together with lists of journals available at the Bureau which deal with specific subjects.

Meanwhile, the Bureau, which started work in April, 1929, has had to deal with current inquiries. These have been, for a start, encouragingly numerous and have come from investigators both overseas and in this country. Whilst ten inquiries have come from six home institutions, a further thirty-five have come from Australia, Canada, New Zealand, South Africa, Ceylon, Sierra Leone, St. Lucia, Seychelles and Kenya. These queries have been very varied in their nature, sometimes raising such general questions as vegetative propagation or plot lay-out, while others refer to such specialized points as the growing of table grapes and the best varieties of and sources for avocadoes. Many of these have necessitated considerable correspondence with other institutions, the writing of précis and the drawing up of bibliographies.

Whenever inquiries have been of sufficient general interest, the Bureau has tried to go rather more thoroughly into the question than perhaps the immediate occasion necessitated, with the object of accumulating the necessary references, etc., for more exhaustive treatment later. For instance, a query on the "Ringing of Fruit Trees" has afforded the opportunity for getting together a considerable bibliography upon the theory and practice of the subject, and of drawing up something in the nature of a small memorandum or technical communication suitable for general circulation to correspondents. Questions on plot lay-out and the technique of recording have afforded a similar opportunity. A technical communication on this subject is in course of preparation.

It need hardly be stated that in this phase of the Bureau's activities the early years must necessarily be largely spent in doing much spade work, the full value of which may not be realized for some considerable time. Like the fruit tree itself, the Fruit Production Bureau must spend a long period in building up the structure which, whilst yielding some fruit in its early years, can only gradually come into full cropping.

Nothing can be more valuable to the work of the Bureau, in trying to cater for such diverse requirements, than the making of personal contacts and the consequent development of a common point of view and standard methods. The first

FIG. 3.—*A tuber affected with Watery Wound Rot, cut open.* In this case air had obtained access to the rotted tissue and it was blackened. The rot has been held up in the region of the "vascular ring," and a layer of cork has been formed between healthy and diseased tissue. (*See p.* 336.)

FIG. 4.—A tuber affected with Watery Wound Rot in which the skin over the decayed tissue has become split, thus allowing the interior to escape. (*See. p.* 337.)

A Watery Wound Rot of the Potato Tuber.

To face page 336.

Fig. 1.—A tuber in a fairly early stage of attack by Watery Wound Rot. The rot started at the wound at the rose end and spread rather irregularly. (*See p.* 336.)

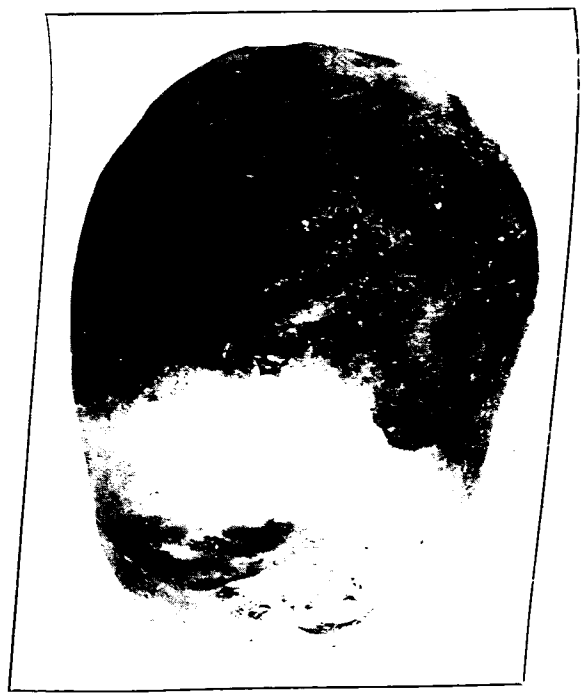

Fig. 2.—A tuber showing a more advanced stage of the rot, the distinction between the rotted and still healthy portions being very clear. (*See p.* 336.)

year has been a distinctly productive one, for the Bureau has welcomed and made contacts, not only with many of the overseas visitors who come to the Research Station, but with a considerable number of workers coming specially to acquaint themselves with the Bureau's activities. Actually, fifty are recorded in the visitors' book. Many of these workers have been primarily interested in tropical and sub-tropical crops, but the exchange of ideas would seem to have been mutually profitable, since there appears to be a somewhat general lack of knowledge as to other work, previous or contemporary, on the same subject. This is only to be expected where these investigators are normally working in comparative isolation.

The Bureau has been instrumental in arranging both itineraries and study courses for overseas workers visiting the continent of Europe and this country. In so doing, it has made additional contacts with workers at various foreign institutions and so obtained a more detailed knowledge of their programmes of research, for purposes of indexing.

The Bureau started with the writer as Director, Mr. D. Akenhead, M.A., B.Sc. Agric. (Lond.) (formerly at the International Institute of Agriculture, Rome, and the investigator who carried out the Empire Marketing Board's survey of Viticulture in Europe), as its Chief Officer, and Miss H. McKeague, B.A., as Secretary. The number of inquiries bearing upon investigational work with tropical plants has been notable, and has necessitated the subsequent appointment of Mr. G. St. Clair Feilden, B.A., formerly of the Department of Agriculture, Trinidad and Tobago, and later of the Horticultural Section of the Public Works Ministry, Cairo (as assistant), to deal in particular with this aspect. These officers have a working knowledge of French, German, Italian, Dutch and Spanish.

It should be made abundantly clear that this development in regard to tropical crops is not in any way designed to serve in the sphere of systematic botany and plant introduction in which the Kew staff are so fully occupied, nor in that of the economic aspects of raw material which is the concern of the Imperial Institute. On the other hand, it has become increasingly evident that a close parallel exists between many of the cultural and experimental aspects of deciduous fruits and certain tropical crops, and it was therefore felt that some immediate arrangement should be made to facilitate a free interchange of ideas and information.

Finally, the Bureau has seized upon the opportunity afforded by the presence of a number of horticultural investigators from overseas, who are attending the International Horticultural and Botanical Congresses in this country, to arrange a Conference of Empire Horticulturists to meet in London, from August 5–7 inclusive. Considerable time has been given to the organization of the programme, which, by inviting contributions from representative workers, is designed to bring under review some of the main problems with which the Bureau is likely to be concerned and the existing methods of attacking them. Among the subjects to be discussed are the application of the pure sciences to problems of fruit production; field investigations, their technique and interpretation; soil and climate surveys in relation to fruit growing; fruit preservation, storage and transport; and the general possibilities for the development of investigation and planting in the future. For the benefit of those who are unable to be present, it is proposed to publish the deliberations.

It is expected that this Conference will bring together physiological botanists, breeders of fruit plants, those studying the chemistry of the plant, the fruit, and soils in relation to fruit production, and the pomologists, versed in their varieties and cultural practices. Indeed, it should be a Conference of all those specialists who are interested in fruit production in its widest aspects. Such a gathering, if it does no more than establish certain common standards, methods and objects, will be of inestimable value to the work of the Bureau and hence, it is hoped, to the cause of experimental work in fruit production throughout the Empire. It will offer an unrivalled opportunity for demonstrating that research in fruit production can be planned and organized upon a thoroughly scientific basis.

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A WATERY WOUND ROT OF THE POTATO TUBER

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AFTER a hot, dry summer like that experienced over the greater part of the country in 1929, serious rotting of potatoes soon after digging would, perhaps, scarcely have been expected. The commonest cause of tuber rotting in more normal seasons is the fungus responsible for Potato Blight, but Blight was conspicuously absent or of very slight intensity in most districts in this year. Nevertheless there were complaints of serious losses due to rot; they related particularly to crops of King Edward, Majestic and Eclipse, but other varieties, such as Boston Kidney and Epicure, were also involved.

The losses were most serious in crops lifted somewhat early, *i.e.*, in September and the first half of October, and occurred largely but not entirely in ware tubers destined for export. In spite of inspection and elimination of visibly diseased tubers on the farms, some consignments reached the port of lading in an unsatisfactory condition. Shipping potatoes of this kind was out of the question, as it was clear they would not travel satisfactorily, and considerable consignments were rejected. It may be pointed out here that early lifting often connotes imperfectly set skins and considerable risk of abrasion and wounding, especially in crops dug with the "spinner." It is also to be noted that the weather at the time of lifting and transport was still warm and summer-like, and therefore not the best for long distance carriage of potatoes.

These circumstances, namely, early lifting in warm weather by the spinner, coupled with the almost total absence of Blight, have at least brought to the forefront and emphasized, if not directly determined, the existence of a type of rapid, watery, potato tuber rot that is not in itself new, although it has perhaps not hitherto received the detailed study and recognition that it deserves. The most serious complaints came from eastern counties such as Lincolnshire and Cambridgeshire, but the same type of rot was also encountered in Shropshire and elsewhere. Several lots of typically affected tubers were submitted to the Plant Pathological Laboratory by the Ministry's Inspectors and by some of the Advisory Mycologists in the provinces, and the following

tes are based on information received and on examination and cultural work with these specimens.

Watery Wound Rot differs in certain important respects om the other and better known kinds of rot that have been udied carefully in this country, such as Pink Rot and rot ie to Blight and Black Leg. It is of a distinctly soft and ot type, but it is not found in the tubers while they are still tached to the plant, although it becomes apparent not long ter lifting. In this respect it differs from the rots mentioned ove. It seems to start invariably from a wound or an rasion of the skin of the tuber, caused during lifting. It es not start, as Pink Rot and Black Leg rot practically ways do, from the actual heel or stem-end of the tuber at ie point where the latter was attached to its stolon, unless, deed, there is a wound there, as is sometimes the case. he skin over the diseased parts is dark and moist, while a ark, sometimes almost black, boundary line is often seen etween the healthy and diseased regions.

The progress of internal decay in the tuber is sometimes, ut not always, fully indicated by the outward appearance of he skin. In Fig. 1, for example, the darkened skin (which hows less contrast in the photograph than it did in the pecimen) surrounds a wound at the rose end of the tuber, nd is continued down the left-hand side; it is more sharply narked off from the still healthy skin in the photograph, however, where a kind of "peninsula" of altered skin runs to the right across the surface of the tuber, lower down. In Fig. 2 the darkened, upper, diseased portion of the tuber is clearly distinguishable from the lower part, still covered by the normal skin. When cut open, the internal rotted parts of these tubers corresponded with the regions indicated by the altered skin.

Quite a different example is illustrated in Fig. 3. Here only two small diseased areas were visible on the exterior of the tuber before it was cut, one at the narrow end, where the wound was situated, and the other slightly higher up at the side. Yet the whole of the interior, up to the region of the "vascular ring," was found to be rotten when the tuber was cut open, as illustrated. It is easy to imagine how a diseased tuber like this might be overlooked upon casual inspection without cutting.

Not infrequently the skin covering the diseased portions no longer follows the original curved contour of the tuber, but is stretched flat and taut over them, consequent upon

internal shrinkage of the rotten tissue. If, as frequently happens on handling, the skin becomes split, a considerable quantity of a thin, watery liquid gradually exudes; and this is a striking feature of this type of rot. Thus there arises the condition illustrated in Fig. 4, where the diseased tissue appears to have "melted" away, leaving the thin papery skin of the tuber behind. Another characteristic feature of the rot is the rapidity with which it progresses. Under favourable circumstances a good-sized tuber may become completely rotten within a day or two. On the other hand, the progress of the rot may sometimes be held up, as already illustrated in Fig. 3, a layer of cork having been formed between the healthy and rotted tissues.

The colour of the decayed tissue exposed when an affected tuber is cut open varies according to whether air has previously had access to the tissue or not. If this has not happened the rotten tissue is but slightly, if at all, discoloured; and a distinct line of demarcation between it and the still healthy tissue may not at first be discernible. On exposure to air, however, the rotten tissue turns greyish, then brown, and finally almost black, sometimes with a slight pinkish tinge in it. The characteristic changes that occur in Pink Rot, namely, first to a decided pink and then to a velvety black, do not occur in Watery Wound Rot. After exposure to air the diseased tissue generally becomes marked off clearly from the still healthy part by a black line; and this stage may already be present in a freshly cut tuber into which air has previously penetrated.

The rotten tissue is quite pulpy, and the cells are no longer coherent, a condition which recalls attack by Black Leg and some other bacterial diseases. In this respect it differs essentially from tissue affected with Pink Rot which remains relatively firm and of rubber-like consistency. Cavities may be present in the rotten tissue, as in Black Leg, but they are not usual in Pink Rot. Occasionally the rot is held up, often in the neighbourhood of the "vascular ring," as shown in Fig. 3. The central decayed tissue then contracts, the liquid in it passes out and a more or less firm shell or wall of practically unaltered cortical tissue remains, thus giving rise to a hollow tuber. The decayed tissues have, at first, merely a slight "fishy" odour; the faint, slightly pungent, chlorine-like smell characteristic of Pink Rot is not perceptible, nor is there any odour suggestive of rancid fat. Later, however, if and when a saprophytic microbial flora develops, as it usually does, the

resulting putrid mass is sufficiently nauseating. When potato tubers are in the final stages of such decay it is frequently well-nigh impossible to determine what the primary cause of the rot may have been.

Examination of the rotted tissues under the microscope revealed at once the presence of an abundance of branched, non-septate, fungus hyphæ, of the well-known phycomycetous type; but no reproductive organs were seen in the tissues at any time. The cell contents, with the exception of the starch grains which at first remained intact, were destroyed, and the cells themselves had become separated from one another. The hyphæ were obviously within as well as between the cells, and could not, therefore, belong to *Phytophthora erythroseptica*, the fungus that causes Pink Rot, or to the Blight fungus, *P. infestans*. The mycelium of these two parasites lies solely between the cells of the host; moreover, that of *P. infestans* can be seen only with extraordinary difficulty in a blighted potato tuber unless special staining methods are employed, whilst that of the Pink Rot fungus, although more readily seen, is by no means very obvious. The hyphæ mentioned were to be found in undiminished luxuriance in the decayed tissue right up to its junction with the still healthy cells; and this, coupled with the fact that no bacteria were conspicuous in this region, led at once to the suspicion that the rot was probably due to a phycomycetous fungus.

By the usually recognized methods, isolations were accordingly undertaken at the Plant Pathological Laboratory, and, without much difficulty, the fungus was obtained in pure culture, studied and recognized to be a species of *Pythium*. It agreed in all essential characters with those described for *P. de Baryanum*, with the exception that no zoospores were observed. The same fungus was isolated in pure culture four times from different consignments of rotting tubers. It was inoculated into healthy tubers and was found to rot them readily and rapidly. In an incubator, at 22° C., the progress of the rot was much more rapid than at room temperature, and the type of decay was identical with that occurring in the naturally rotting tubers. The fungus was recovered again in pure culture from the artificially rotted tubers, hence there was no doubt that it was responsible for the trouble encountered. Tubers of a number of different varieties were inoculated through wounds, but they all rotted with equal promptitude; none showed any sign of being resistant. The fungus was found to be incapable of traversing the undamaged skin of the tuber.

Pythium de Baryanum is a parasitic fungus the name of which, at any rate, is well known to students and others; but, so far as this country is concerned, it does not appear to have been associated previously with a specific potato tuber rot. It is commonly coupled with the so-called "Damping-Off" disease of seedlings grown under unsuitable conditions of temperature and moisture, and in recent years it has been proved to be one cause of the so-called "Black Leg" disease of zonal Pelargonium (Geranium) cuttings.[1] It produces "resting" spores in abundance, both sexually and asexually; these occur quite commonly in cultivated soil and are the sources from which disease in due course springs.

The fungus was first studied and described by R. Hesse[2] in 1874, in connexion with the diseases of certain seedlings, whilst a year later, R. E. B. Sadebeck[3] encountered it on potatoes in a field near Coblentz. A. de Bary,[4] in 1881, recorded that a potato tuber inoculated by him with this Pythium from a diseased Cress seedling became wholly decayed in a few days in warm weather. H. Marshall Ward, in his studies on Pythium, published in 1883,[5] stated that a potato tuber afforded a good medium for the cultivation of *P. de Baryanum*, and reported that the parasite left the starch grains untouched, although the other cell contents were destroyed.

For more than 30 years subsequently nothing appears to have been written about *Pythium de Baryanum* in its relation to potato tubers, but in 1916 L. A. Hawkins[6] described this fungus as one of the causes of what is called potato "Leak" in the U.S.A., a disease of considerable importance in potatoes shipped from the delta region of the San Joaquin River, California. Three years later this author, in conjunction with R. B. Harvey,[7] published the results of an interesting physiological study on the parasitism of *P. de Baryanum* on the potato tuber, in which, amongst other things, special attention was paid to the method by which the cell walls are penetrated by the hyphæ of this fungus. G. K. K. Link,[8] in 1922, in a short note dealing with "Leak," stated that it had been demonstrated by isolations and inoculations that

[1] W. Buddin and E. M. Wakefield: "Black-Leg" of Pelargonium Cuttings. *Gard. Chron.*, 75, 1924, p. 25.
[2] Inaug. Diss., Halle a/S., 1874, 76 pp.
[3] *Sitzungsber. Ges. Naturf. Freunde*, Berlin, 1875, p. 148.
[4] *Bot. Zeit.*, 39, 1881, p. 528.
[5] *Q. J. Micros. Sci.*, 23, 1883, p. 485.
[6] *Jour. Agric. Res.*, 6, 1916, p. 627.
[7] *Ib.*, 18, 1919, p. 275.
[8] *Phytopathology*, 12, 1922, p. 38.

most cases of this disease were caused by Pythium-like fungi. Both this author and Hawkins emphasize the point that Pythium rot is accentuated by hot weather, whilst Hawkins also lays stress on the importance of wounds for the entrance of the parasite into the tuber.

Control.—As to the avoidance or control of this Watery Wound Rot of potato tubers it is to be noted that the disease is contracted from a parasitic fungus present in the soil, and that the return of the rotten tubers to the soil is a sure way of maintaining and even increasing its presence there. Such a proceeding is quite contrary to the demands of proper crop hygiene and should not be followed.

It is instructive to learn that this particular rot was prevalent on the land of certain farmers who do not make a practice of gathering up and destroying all diseased tubers after lifting time, whereas their neighbours who go to the trouble of doing this as a matter of routine did not suffer.

Where potatoes are grown year after year, or in short rotation, on the same land there is great risk of the occurrence of this trouble, as well as of other potato diseases, unless strict plant sanitation measures are adopted.

The most obvious means of preventing the rot is to avoid, as far as possible, mechanical injury to the tubers during lifting and handling. The "spinner," from this point of view, would appear to be the worst type of implement to use, and some other less damaging appliance should be employed in its stead. This is of particular importance if potatoes are lifted before they are fully mature and if warm weather conditions prevail at the time.

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A SURVEY OF PIG-KEEPING IN KENT

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WHILE new facts are obtained, and improved methods evolved, largely as a result of carefully planned research work, it should not be overlooked that much knowledge regarding farming practice has been accumulated by practical farmers, and that a study of their methods will invariably yield useful information. This line of investigation was adopted by the writer in carrying out a survey of pig-keeping in Kent by studying the conditions under which pigs are kept, and the methods upon which they are managed, upon a large number of farms.

Most of the pigs are kept upon the fruit farms* of which there is a large number in the county. There are several herds of between 80 and 100 breeding sows, whilst herds of between 20 and 30 breeding sows are quite common, and practically all the pigs bred are fattened. They are kept primarily for their manure, which is so highly valued that some farmers are prepared to keep pigs even if the animals are bred and fattened at a loss.

On many fruit farms, it is the practice to divide the orchards or plantations into comparatively small enclosures, in each of which a pig hut is erected. The size of these enclosures varies considerably; most of them are between ¼ acre and 1 acre, but some are 2 to 3 acres in extent. The enclosures are stocked with pigs for a considerable portion of the year. Pigs cannot be run amongst bush trees or some half standards when they are carrying fruit, and it is not desirable to have them in apple orchards when the fruit is falling. Many growers state confidently that the yield of fruit is increased by running pigs under the trees, but others do not consider it sound practice. The latter state that in their opinion scab in apples is increased by direct manuring with pigs, and also point out that the manure is spread very unevenly, with the result that some trees derive no benefit.

The writer would point out that the manure from pigs which are being fed in accordance with modern ideas (*e.g.*, upon rations containing 5 to 10 per cent. of fish meal or other protein supplement) is rich in nitrogen and comparatively poor in phosphates and potash, and it seems highly probable that,

* The term "fruit farm" is here used to describe any farm on which fruit is grown on a commercial scale. Some farms are devoted wholly to fruit, but upon others only a portion of the land is under fruit.

unless pig manure is supplemented by phosphatic and potassic manures, a certain amount of damage may be done by unbalanced manuring. As regards the uneven spreading of manures, observations made at this College indicate that, if pens are lightly stocked, the bulk of the manure is deposited in one place, but, if the pens are heavily stocked, the manure is comparatively evenly spread.

Upon some farms, unrung pigs are kept in plantations which they are allowed to root up, it being claimed that the pigs, by rooting, cultivate the ground and that they keep down weeds, thus rendering unnecessary the very expensive cultivations usually given to plantations. Other growers consider this to be bad practice, stating that pigs only partially keep down weeds, and that, whilst the animals root up some parts of the plantations excessively, other parts remain untouched.

The writer's observations, however, indicate that the efficiency of the practice depends upon the way it is carried out. If the pens are heavily stocked during the spring and early summer, weeds are kept down and the whole area gets rooted up. On the other hand, if they are lightly stocked at this time of the year, the work of keeping down weeds and cultivating the ground is done imperfectly.

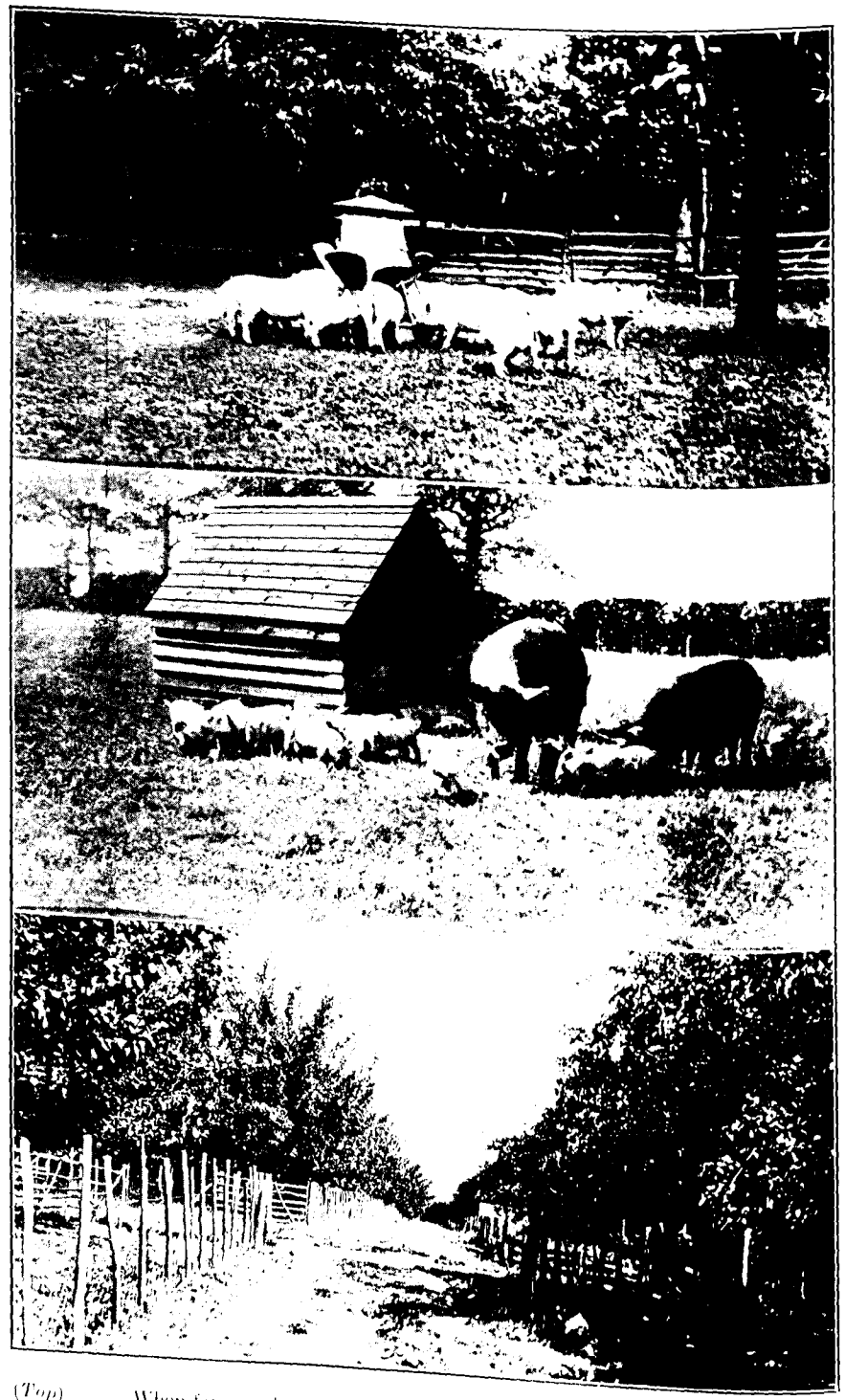
In considering the methods of management employed upon fruit farms two points should be borne in mind :—

(1) That it is comparatively simple to develop the "open air system" of pig-keeping in orchards and plantations because water is almost invariably laid on.

(2) The direct financial returns from the sale of pigs are generally small when compared with those from fruit and other specialized crops.* In consequence, the management of the pigs is frequently governed by the requirements of other sections of the farm, and may be determined irrespective of whether it is the best way of treating pigs.

The sows, whilst in-pig, are almost invariably run in the orchards and meadows. On a large number of fruit farms they are farrowed in the orchard or plantation runs all the year round. In other cases, the sows are farrowed out of doors during the summer and in the buildings during the winter. A number of farmers who had tried both indoor and outdoor farrowing stated that they got better results by farrowing in the outdoor runs all the year round. A few men bring their sows into the

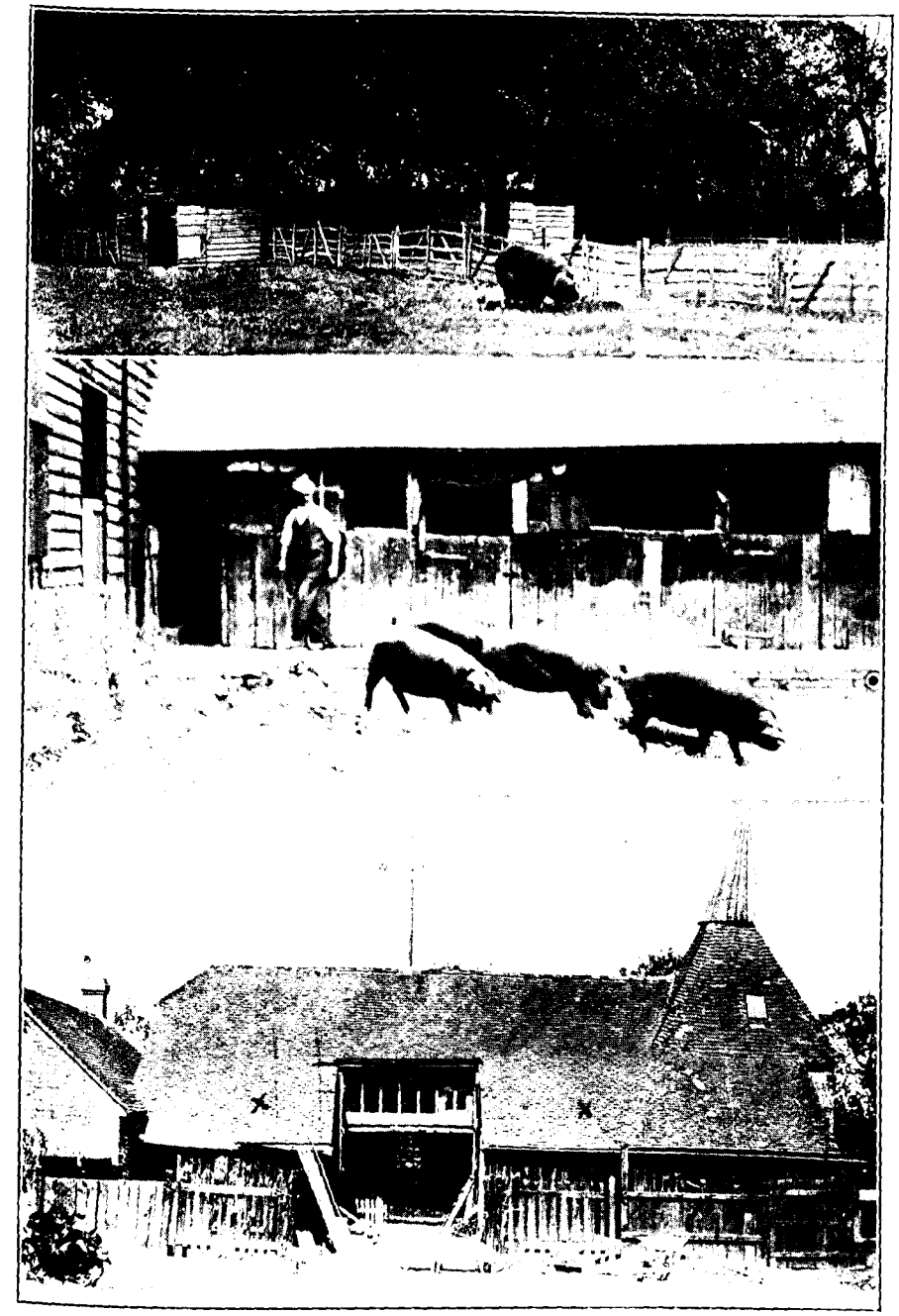
* Notably hops and market garden produce.



(*Top*) When farmyard manure is not required, the young pigs, after weaning, are left in the orchard runs. Dry feeding is practiced on a few farms, automatic feeders being employed.

(*Centre*) There are times when pigs cannot be kept amongst the fruit trees and alternative accommodation must be provided.

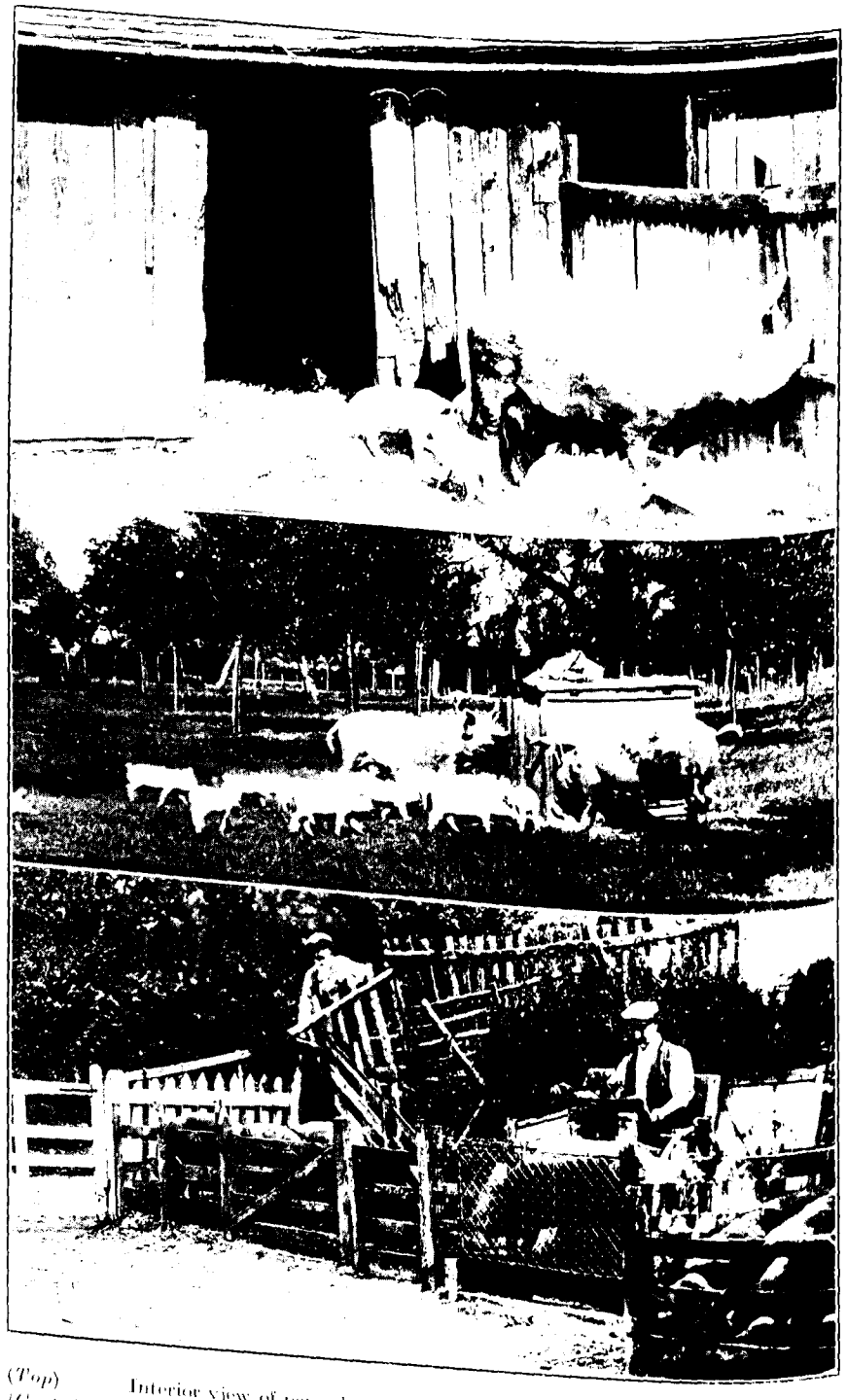
(*Bottom*) On one well laid out fruit farm, the orchards and plantations are divided up into sections by an 8ft. road, which enables pig food to be transported expeditiously to the pens by motor van.



(*Top*) Open air runs on grass are occasionally found on mixed corn and grass, and on grass farms.

(*Centre*) The more common system is to keep the pigs in buildings, letting them out to graze in the adjoining fields when convenient.

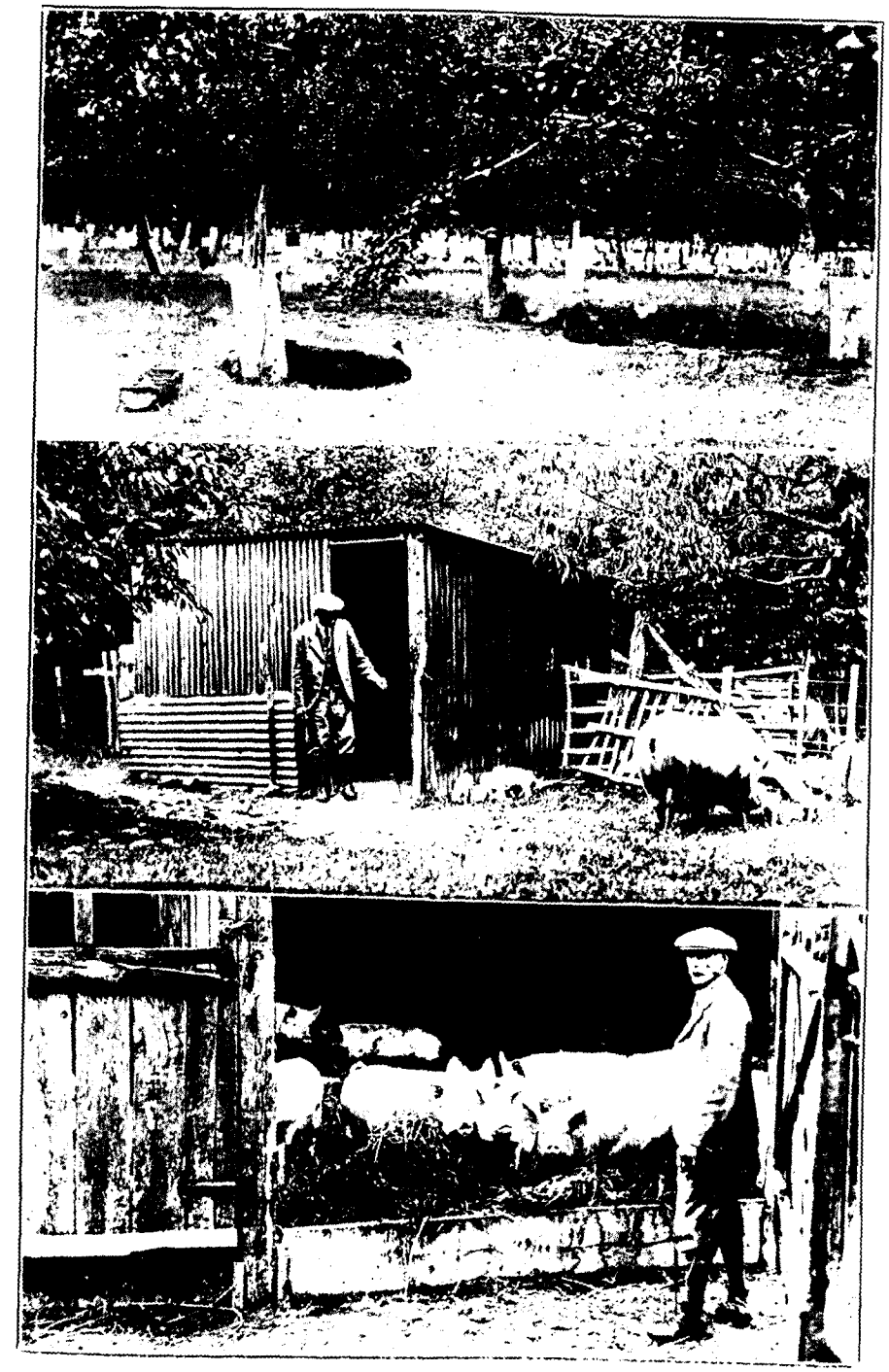
(*Bottom*) Pig pens (marked X) have been made from an old lean-to cowshed on the side of a Kent barn and disused oast.



(*Top*) Interior view of pens shown in view, bottom of previous page.

(*Centre*) A unique method of farming young pigs. When the sows have taught their young to eat, the feeder is fenced off, a creep being left through which only the young pigs can pass.

(*Bottom*) A convenient weighing pen made with farm labour. Very few farmers weigh their pigs. An arrangement such as this costs but little and the information obtained by its use is often invaluable.



(*Top*) On fruit farms, in-pig sows are usually kept in the orchards during the greater part of the year.

(*Centre*) On many fruit farms, the sows are farrowed in the orchard runs both in winter and summer. The huts in these runs are very frequently made of corrugated iron.

(*Bottom*) When farmyard manure is required, the young pigs after weaning are kept in the buildings.

A SURVEY OF PIG KEEPING IN KENT.

To face page 342.

buildings to farrow and transfer them to the orchard runs with their litters, both in summer and winter, when the young pigs are from two to three weeks old. The treatment of the young pigs after weaning is usually determined by the requirements of the farm. If farmyard manure is required, they are generally brought into the yards; if it is not required they usually remain in the orchard runs. In the latter case, it is the general practice to bring the pigs into the yards for from three to four weeks' feeding before marketing them in the winter. In the summer, they are rarely brought into the yards for more than two to three weeks, and in many cases they remain in the orchard runs until fit for slaughter.

There are numerous mixed arable and grass farms in the county upon which specialized crops are not grown. Pigs form part of the live stock upon many of them, but the number kept is usually comparatively small—not more than half-a-dozen breeding sows and their progeny. Generally, no definite system of management is followed, but, occasionally, open-air farrowing runs on grass are found on this type of farm. The more common practice, however, is to keep the pigs in the farm buildings and to let them out, when convenient, to graze in the adjoining fields. The pigs are looked upon as a convenient method of utilizing damaged corn and chat potatoes, for which there is not a ready sale; the use of such materials enables food bills to be kept comparatively low. Straw has not to be purchased and the animals make no appreciable difference to the labour bill.

Grass farms are also comparatively numerous: upon the greater proportion of them pigs are not kept.

In several parts of the county, where large quantities of swill are to be obtained on favourable terms, pig-fattening businesses have been established. Two of these were visited. In both cases the practice is to buy pigs of between 60 and 120 lb. liveweight. The larger pigs are preferred, many of the pigs purchased being fit to kill for pork. They are finished at 200 to 240 lb. liveweight. The swill is sterilized and mixed with barley meal. The pigs are housed in buildings with concrete floors and it is considered very necessary to keep them clean. The food is cheap, but the mortality amongst the pigs is high. It was stated that considerable loss is occasioned by the fact that materials such as soda and salt frequently find their way into the swill in toxic quantities.

Shortly after the War, there were established in the county numerous "breeding farms" which were organized principally for the production and sale of first-class breeding stock. During recent years the number has rapidly decreased. Notes are to hand on twelve which have closed down during the past two years because they did not pay. The reason for their failure appears to be that there is a very limited demand for breeding stock, even when the price of pork and bacon pigs is comparatively high, while, when it is low, boars and in-pig gilts are practically unsaleable.

It is notable that some of the best pigs seen during this survey were found upon farms on which the buildings were poor. As a rule, the permanent farm buildings in the county include few pigsties. A few farmers have erected special buildings, but this is exceptional, and, where pigs are kept "indoors," they are generally housed in cattle yards, loose boxes, hovels, old cowsheds, or any other available building.

Most of the buildings have floors of earth or rammed chalk; for many experienced pig-keepers are firmly convinced that if pigs lie on concrete they will develop disease. The huts in the orchard runs are generally made of corrugated iron. Only on 12 per cent. of the farms visited were wooden huts in use, and many of these were roughly built and very draughty. Huts made by packing a rough framework with bracken were found on one farm; the owner stated that they were very satisfactory except for the fact that they harboured vermin.

Methods of Feeding.—On 95 per cent. of the farms studied, wet feeding is practised, *i.e.*, the rations are soaked before they are fed. Where meal is fed dry, automatic feeders are generally used. On one farm, dry meal is fed in sheep troughs made with a special high back to prevent the meal being blown away. Pig nuts (or cubes) are in use on a few farms, in some cases being put into troughs, though the more usual practice is to scatter them on the ground. Many of the most successful breeders pay considerable attention to the feeding of their young pigs whilst on the sow. The most common practice is to place a trough, which is kept supplied with food, behind a creep through which only the little pigs can pass. Some breeders run several sows and suckling pigs together after the piglings are a fortnight old, the idea being that the older pigs teach the younger ones to eat and to use the creep. A system practised upon one of the best managed farms visited is worthy of special mention. Wet feeding is practised upon this farm, but the suckling pigs are allowed access to a dry feeder which

always contains meal. When the piglings are about a fortnight old the dry feeder is placed in the run and the sow's ration of wet food is slightly reduced. The sow is allowed access to the dry feeder until she has taught her pigs to eat, then a fence is put round the feeder with a creep for the piglings, and the sow's ration of soaked meal is increased.

The practice of feeding different rations to pigs of different ages is rarely followed. Farmers state that it is not practicable to have a large number of different rations in use. A method of rationing which was found on one well-organized farm seems worthy of development. A "standard mixture" is made which is suitable for pigs of 70 to 100 lb. liveweight. This is issued to the pigman together with a quantity of sharps and barley meal. The pigman is told to mix sharps with the standard ration for the sows and young pigs, and to add barley meal when feeding fattening pigs.

Upon 30 per cent. of the farms studied, mixtures of barley meal, maize meal and sharps were given without any protein supplement. The pigs which had access to grass looked remarkably well, and in no case was scour reported to give trouble amongst the young pigs. The in-pig sows on this type of ration were rather fat. The sows apparently lost condition very badly whilst suckling their young. Upon 50 per cent. of the farms visited the same foods were used with the addition of 5 to 10 per cent. of fish meal, vitamealo, or gromax. The most popular mixture was 60 per cent. barley meal, 30 per cent. sharps and 10 per cent. fish meal, but many farmers stated that they altered the proportions according to the price of the different foods. It was apparent that in many instances the mixing was done in a haphazard manner. Potatoes were fed on a large number of farms when available, but it was very exceptional to discover any attempt to make good their deficiency in protein.

Types of Pig Kept.—On the whole a very good class of pig is kept in the county. The two most popular breeds are the Large Black and the Middle White. The Large Black sows are generally crossed with either a Large or Middle White boar. Of the two crosses, the Large White is slightly the more common at present, but the popularity of the Middle White cross is increasing. Feeders state that the latter cross grows quicker than the former. Middle Whites are usually kept pure. No other breed is kept to any appreciable extent, but herds of Large Whites, Berkshires, Tamworth, Essex, Wessex and Gloucester Old Spot are occasionally to be found.

Records of growth and age are not kept by feeders, and it is exceptional to find a farmer who weighs his pigs regularly. It seems highly probable that, in many cases, great benefit would accrue if such records were available. In the absence of growth records, breeding stock is selected chiefly on conformation and breeding capacity. A comparatively prolific type of sow is to be found in the county. During the summer eight to nine pigs per sow are reared on a large number of farms, but, in many instances, it was found that the mortality amongst piglings during the winter months was high. Actual figures could not be obtained on this point.

In the centre and south of the county, the majority of the pigs were marketed as large porkers (140 to 160 lb. liveweight) or as baconers. In the north, porkers (100 to 120 lb. liveweight) are the most popular type.

Methods of Marketing.—The close proximity of London and a number of prosperous seaside resorts places farmers in the county in a favourable position for marketing pigs. A few send direct to bacon factories or butchers, but the great majority of the pigs are sold by auction in the local markets, at which supplies frequently exceed buyers' requirements, with the result that prices slump.

The survey has shown that pig-keeping fits in very well with the systems of farming employed upon a large number of Kentish farms, but upon many of the farms pigs are not kept at all. The inquiries which have been made indicate that if a system of marketing could be evolved which would stabilize prices, or at least prevent the slumps which occur under existing conditions, the number of pigs produced in the county would be increased to a very considerable extent.

The writer desires to thank all those who made the survey possible by allowing him to study the conditions on their farms, and for the trouble they took in showing him round and explaining their methods of management.

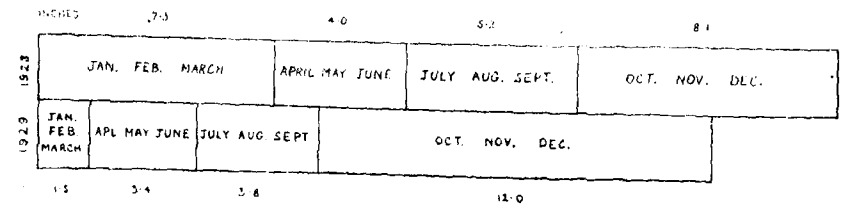
* * * * * *

EFFECT OF ABNORMAL WEATHER CONDITIONS ON THE QUALITY OF MILK

HAROLD T. CRANFIELD,
Advisory Chemist, Midland Agricultural College

A PROLONGED period of rain or drought is rarely experienced in the British Isles, and farmers are indeed fortunate that the insularity of our country results in a climate of great variability. One hears constant grumbling when a period of fine weather is suddenly terminated by rains, but there is no doubt that our systems of farming would have to be radically altered if the meteorological conditions of the British Isles were permanently changed.

During the period extending from the autumn of 1928 to the spring of 1930, the climatic conditions in the Eastern, South-Eastern, and East Midland parts of England were very abnormal. Little rain fell in the winter, spring and summer of 1929, and this period of comparative drought was followed by abnormal rainfall in the late autumn and early winter of that year. Diagram 1 illustrates the amount and distribution of rainfall during this period in South Nottinghamshire.



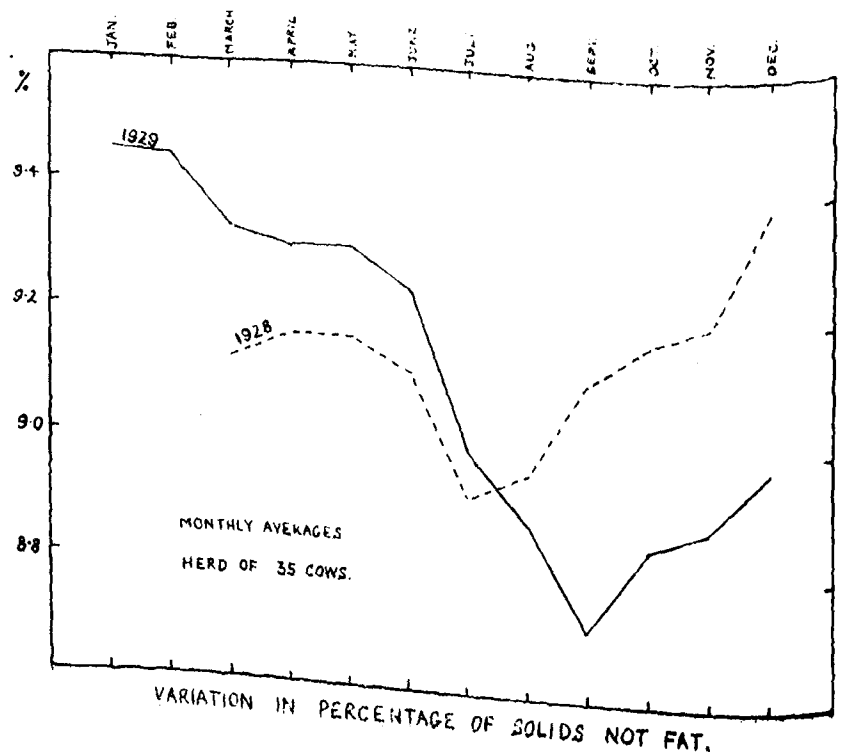
RAINFALL IN SOUTH NOTTS. 1928-29.

As a result of the 1928–29 drought, meadows and pastures carried little grass, especially on the lighter soils. The comparatively low rainfall in the winter and spring was insufficient to build up a reserve of underground water from which the grass land could draw a supply of moisture in the summer, and this effect on the grass land was further accentuated by the dry spring and summer which followed.

This diminution in the growth of grass resulting in a drying up of the pastures and a scanty crop in the meadows presented a serious problem for the dairy farmer. In England, the bulk of milk during the period May to October is produced from grass, whilst the produce of the meadows contributes largely to the maintenance ration in the winter months. Those farmers whose practice it is to grow green fodder crops were able to supplement the scanty herbage on the pastures by lucerne, tares, oats,

etc., but many were not so fortunate, and perforce maintained their herds by feeding concentrates, in fact during September —which was an almost "totally dry" month in some districts— full winter rations were necessary, particularly in the case of herds where a normal supply of milk was essential.

It is well known that where a factor causes a drop in the yield of milk of a herd, the fat percentage rises in the majority of cases. There is no doubt that many farmers last summer were getting milk richer in fat than they realized, since this increased richness would be noticed only by those who periodically test the quality of their milk, or who make butter. The most remarkable effect, however, of the burnt up pastures was the depression in the percentage of non-fatty solids. This fall in quality was very serious in some herds, so serious in fact that the bulk milk frequently contained less than the presumptive limit of 8·5 per cent. Normally the non-fatty solids content reaches its lowest level in July, rising again in August, but last year the maximum of the depression occurred in September, *i.e.*, in the driest month. An example of this effect is shown here in Diagram 2.



The graph illustrates the variation in the monthly average percentage of non-fatty solids in a herd of 35 Shorthorn cows, the mixed milk of which has been sampled daily and analyzed since March, 1928. Although this herd received a supplementary ration during the drought period, the fall in the percentage of non-fatty solids was most marked, and only the general high average quality of the milk from this herd saved the percentage falling below 8·5 on all except three occasions.

Another series of figures from the writer's laboratory supplied corroborative evidence of this effect. Since the beginning of 1929, monthly samples of bulk milk from approximately fifty herds in Nottinghamshire have been received for analysis. Monthly variation in the non-fatty solids content of the milk from these herds is given in the following table :—

Month	*Number of Herds sampled*	*Average percentage Non-fatty Solids*	*Percentage of Samples below 8·5 per cent.*
January ..	32	9·06	0
February ..	41	9·04	5
March ..	46	9·04	5
April	54	8·91	0
May	50	8·93	6
June	47	8·94	4
July	75	8·84	16
August ..	45	9·00	4
September ..	49	**8·53**	**45**
October ..	49	8·89	4
November ..	20	8·95	0
December ..	49	8·99	2

It will be observed that nearly half of the September samples fell below the presumptive limit of 8.5 per cent. in non-fatty solids.

This drought effect has been noted in past years by other observers. One finds the following paragraph in the Report on Evidence submitted to the Board of Agriculture Committee appointed in 1900 to inquire and report as to what regulations (if any) might with advantage be made for determining what deficiency in any of the normal constituents of genuine milk or cream should raise a presumption, until the contrary was proved, that the milk or cream was not genuine :—

"Unusual meteorological conditions—as, for instance, a prolonged drought or excessive rainfall—were referred to as unavoidably affecting the condition of cows and the quality of milk. A period of drought, however, tends apparently—while no doubt diminishing the yield—to raise the percentage of fat in milk, although it is stated that at the same time the solids not fat decrease. A period of excessive rainfall

would probably have the effect of impoverishing milk, and two witnesses referred to the disastrous year 1879 as an instance of this."

F. J. Lloyd, a former chemist to the British Dairy Farmers' Association, in an article published in Vol. XIX of the Journal of that Association, states that in 1898 and 1899 (very dry years) milk fell below 8·5 per cent. in solids not fat during August and September, whilst the fat percentage was above the normal. He also mentions that the effect was only temporary.

A more recent reference to the effect of dried-up pastures is found in the bulletin on "The provision to towns of milk of proper composition," by Dr. F. E. Nottbohm of Hamburg. In reviewing the influence of seasonal changes on the solids not fat content of milk in Germany, Nottbohm refers to a serious fall in this constituent during July and August, so much so that the samples below 8·2 per cent. solids not fat are numerous. He is of the opinion that lack of albuminoids, due to the constantly grazed pastures being dried up by the sun, is responsible for this fall. It appears that in Germany, where such conditions often prevail, farmers try to guard against this contingency by feeding concentrates. Whether this has or has not the desired effect is not stated by Nottbohm.

The writer suggests that dairy farmers should be cognizant of the effect of weather conditions on the composition of milk, and moreover include this remarkable drought factor in the list of unavoidable causes which from time to time may bring the quality of their milk under suspicion of adulteration in the eyes of their customers and local authorities.

* * * * * *

MARKETING NOTES

National Mark Egg Scheme.—Considerable increases in the output of the packing stations as compared with last year are reported, and it is believed that this is to a large extent due to the growing realization of the good service which is rendered by the packers to both producers and distributors. There has recently been a tendency, however, for producers to exploit the packing stations as a convenient outlet for temporary surpluses. This has notably been experienced by stations managed by producers' co-operative societies, and although the National Mark organization has placed packers in an advantageous position with regard to the disposal of unexpected increases in supplies, it is important to bear in mind that such irregular methods on the part of producers have, in the past, proved inimical to the best interests of the British egg trade. It has been established that producers who contract with National Mark packers for the disposal of their entire output for twelve months of the year receive a better average return than that resulting from hit-or-miss methods of marketing, despite the fact that, on occasion, higher prices than the contract prices can be realized elsewhere.

The favourable influence of the National Mark scheme on the prices of English eggs is indicated by the difference in price between English and Danish eggs which has existed this year as compared with last year. In April, 1929, the average price of Danish "18-lb." eggs was 14s. 4d. per 120, while that of English National Mark "Specials," which roughly corresponded to the Danish "18-lb." eggs in weight, was 14s. 4½d.—a difference of only ½d. per 120. In April, 1930, the respective average prices for the same grade of eggs were 12s. 9d. and 13s. 10½d. per long hundred; there was thus a difference of 1s. 1½d. and an increased difference over 1929 of 1s. 1d. per 120. Similarly, in the case of Danish "15½–16-lb." eggs and English National Mark "Standards," the April, 1929, average prices were 12s. 2d. and 13s. 3d. respectively, while those in April, 1930, were 11s. 3d. and 12s. 9½d. The margin between the prices of the two kinds of eggs in 1929 was 1s. 1d.; in 1930 it was 1s. 6½d.—an increase of 5½d. per 120.

Grocers and the National Mark.—Referring with appreciation to the support which the Federation of Grocers' Associations had given to the National Mark Egg Scheme, Mr. Buxton, the late Minister of Agriculture and Fisheries, speaking at a luncheon on May 22, said that he was glad to say that the supplies of National Mark eggs passing from the packing

stations to the retailers, either direct or through wholesale channels, showed an encouraging increase. Moreover, distribution had been greatly accelerated, this being beneficial alike to the producers, the packing stations, the distributing trade and the public. Speedy distribution not only ensured that the eggs were fresh when they reached the consumer, but it obviated abnormal instability of prices caused by congestion in wholesale markets. This great improvement had been brought about by the organized distribution from the packing stations by the new packers' organization—National Mark Egg Central Limited—which had been incorporated with the assistance of the National Farmers' Union and of the Ministry. This body acted as an agency for developing wider outlets for the sale of National Mark eggs and for securing even distribution of supplies in the large consuming centres. Egg packers were entrusting a growing proportion of their output to the Egg Central, and the whole development was a creditable and very gratifying example of co-operative marketing, to which the present Government attached much importance.

Referring to the question of the sale of eggs by weight, Mr. Buxton said that it was generally felt that something should be done on these lines as soon as possible, and the best method of applying to the egg trade the equitable principle of sale on a weight basis was a matter which was being most carefully examined by the Ministry in conjunction with various interests concerned.

National Mark Dressed Poultry.—As indicated in the article on Dressed Poultry—Grading and Marking, published in the June issue of the JOURNAL, it was anticipated that the National Mark Dressed Poultry Scheme would make a relatively small beginning. The scheme is expected to have wider effect as the industry appreciates the value of up-to-date methods of offering dressed poultry to the markets. Three applications for enrolment in the scheme have so far been approved and further applications are under consideration. Inquiries for the leaflet explaining the scheme have been received from all parts of the country.

The following are the packers who have, so far, been authorized :—

County	*Name and Address*	*Registered No.*
Kent	Shenley Poultry Products, Ltd., Headcorn	1

County	*Name and Address*	*Registered No.*
Worcestershire ..	Kidderminster Poultry Products, Ltd., Station Yard, Kidderminster	2
Surrey	Surrey Fat Stock Farm, Brookwood	3

National Mark Beef.—The number of sides of beef graded and marked with the National Mark each week for the seven weeks ended June 21, 1930, was as follows :—

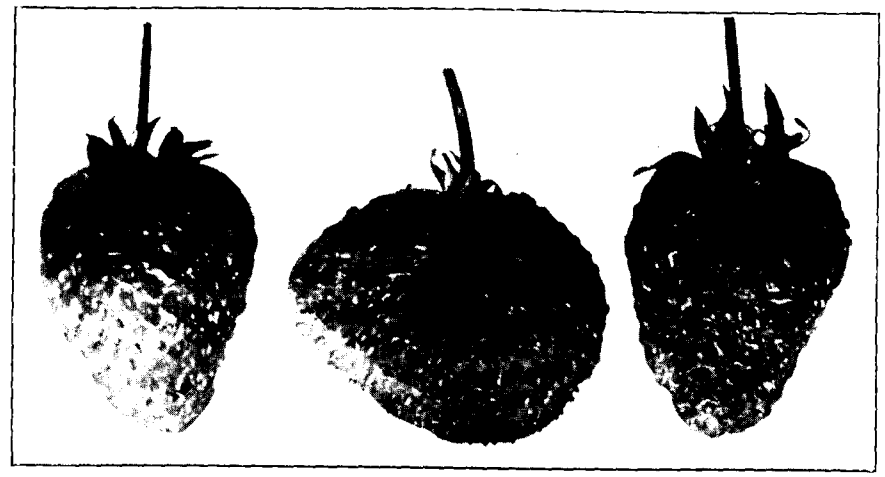
Week ended	*Select*	*Prime*	*Good*	*Total sides graded and marked (Quarters and pieces omitted)*
		LONDON		
May 10 ..	951	1,202	130	2,283
,, 17 ..	787	1,229	131	2,147
,, 24 ..	739	1,153	75	1,967
,, 31 ..	889	1,185	40	2,114
June 7 ..	643	1,131	66	1,840
,, 14 ..	575	1,214	28	1,817
,, 21 ..	755	1,220	44	2,019
		BIRKENHEAD*		
May 10 ..	—	74	—	74
,, 17 ..	5	89	2	96
,, 24 ..	37	150	6	193
,, 31 ..	37	137	3	177
June 7 ..	24	143	—	167
,, 14 ..	26	145	—	171
,, 21 ..	20	158	—	178
		SCOTLAND*		
May 10 ..	2,216	428	—	2,644
,, 17 ..	2,477	622	—	3,099
,, 24 ..	2,055	487	—	2,542
,, 31 ..	2,104	494	—	2,598
June 7 ..	1,950	495	—	2,445
,, 14 ..	2,317	490	—	2,807
,, 21 ..	2,200	512	—	2,712
		TOTAL LONDON SUPPLIES (*All Sources*)		
May 10 ..	3,167	1,704	130	5,001
,, 17 ..	3,269	1,940	133	5,342
,, 24 ..	2,831	1,790	81	5,702
,, 31 ..	3,030	1,816	43	4,889
June 7 ..	2,716	1,769	66	4,452
,, 14 ..	2,918	1,849	28	4,795
,, 21 ..	2,975	1,890	44	4,909
		BIRMINGHAM		
May 10 ..	122	243	8	373
,, 17 ..	125	205	11	341
,, 24 ..	98	244	10	352
,, 31 ..	51	188	6	245
June 7 ..	37	61	—	98
,, 14 ..	27	81	2	110
,, 21 ..	41	78	2	121

* Sides consigned to London.

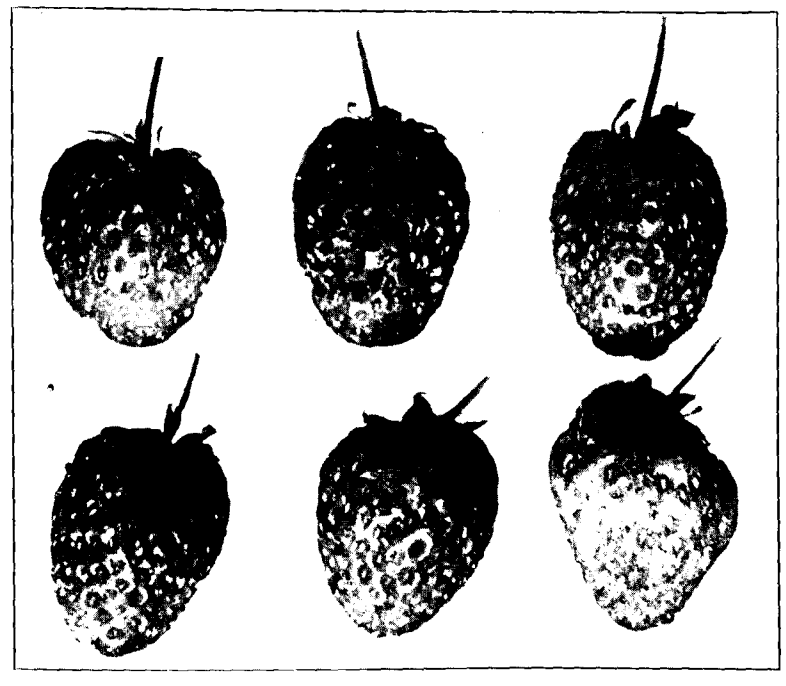
An interesting feature of prices during the week ended May 31 was that Scotch "Select" and English "Select" were quoted at the same figure (in the *Agricultural Market Report*). This has now been the case for two weeks, and it is evidence that, through grading and the confidence which grading brings, the quality of home-killed "Select" has at last obtained due recognition on the market.

On May 31, the Birmingham wholesale butchers refused to have their beef graded before sale, thus putting to considerable inconvenience those retailers who have supported the scheme throughout, and who have been in the habit of buying their National Mark beef at the City Wholesale Meat Market. Those with private slaughterhouses were, of course, unaffected. In the following week, the Ministry made arrangements so that buyers on the Wholesale Meat Market could have their purchases graded and marked after sale. The wholesalers' attitude is deplored by the Midland beef feeders, who have voiced their whole-hearted support of the scheme in a letter to the Birmingham press. In the main, the decision of the wholesalers appears to have been taken on the ground that there was no public demand for National Mark beef. Although considerable publicity has been given to marked beef in Birmingham, it has been somewhat intermittent. The statistics of sides graded and marked show that during the weeks of intensive publicity the amount of beef marked rose in a satisfactory manner. Even up to the moment of the wholesalers' decision, the percentage of "Select" beef that was going to Birmingham showed an appreciable increase. It must be remembered that the organized retail trade in Birmingham has never accepted the scheme in the way that the London butcher has come to regard it. This has undoubtedly affected the wholesalers' attitude. It is satisfactory to note that the wholesalers make no complaints as to the accuracy and method of grading. In the early days of the scheme, the trade advanced the argument that beef, unlike other commodities, could not be graded. Experience in London and Birmingham has shown that this is incorrect.

The experimental consignments of cattle direct from farms to the Islington Abattoir have been continuing, though in some cases the quotations given by the wholesalers on Smithfield Market have not proved sufficiently attractive to make senders prefer this method of sale on grade and weight to sale in the local market. The figures of a recent consignment from Norfolk are of some interest as showing the "gain" in dead weight over live weight which is revealed by this method of



"Extra Selected" Grade. Minimum size of strawberry (½ oz.) permitted in "Extra Selected" Grade.



"Selected" Grade. Minimum size of strawberry (¼ oz.) permitted in "Selected" grade.

NOTE. "Selected" grade may include strawberries which fulfil the requirements of "Extra Selected" grade.

NATIONAL MARK STRAWBERRIES (see p. 355).

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sale. Ten bullocks were sent on May 28 to Islington which weighed out and were graded as follows :—

Live 14-lb. *Stone*	*Dead* 8-lb. *Stone lb.*	*Grade*
73	79 0	Select
70	73 2	Prime
90	100 2	Select
98	106 6	Select
92	100 5	Select
86	99 4	Select
71	75 0	Select
88	94 3	Select
72	76 1	Prime
89	96 6	Prime

In this case, the feeder had done his cattle well and the percentage of " gain " was in one or two instances remarkably high. The bullock weighing 86 stone liveweight which " gained " 13 stone 4 lb. in terms of deadweight was a notable example. It is at least doubtful whether buyers in an auction mart would allow for " gains " of this magnitude. The system of selling by grade and weight would appear to be a considerable safeguard, therefore, to the good feeder, since he is paid for the actual weight of meat that his cattle yield.

National Mark Tomatoes and Cucumbers.—Further applications for enrolment are steadily coming in. The total number of authorized packers is now 85 for tomatoes and 29 for cucumbers.

National Mark Strawberries.—Following upon the issue of Marketing Leaflet No. 18, and aided by extensive publicity, which has comprised a series of articles in the fruit trade press, the distribution of leaflets, and addresses to growers by the Ministry's Marketing Officers, the National Mark Strawberry Scheme bids fair to achieve considerable success in its first season. 84 applicants for enrolment in the Scheme were authorized up to June 21.

The accompanying illustrations show the sizes of strawberries permitted in each of the two statutory grades.

The traders' organizations are strongly supporting the Scheme as being of great advantage to them in the matter of guaranteed weights and quality. In order to assist in the marketing of the fruit, a series of attractive window cards has been prepared.

The following is the first list of authorized packers in the Scheme :—

Cambs.: A. E. Bunting, Bontinck Farm, Terrington St. John, Wisbech.
R. G. Lee, Upwell, Wisbech.
E. H. Miller, Walton Road, Wisbech.
J. O. Tonkin, Limberlost, Outwell, Wisbech.
A. M. McGregor, Birds Pasture, Dry Drayton.
T. Chapman, York Road, Wisbech.
Cheshire: H. C. Groom & Co., Bellevue Farm, Guilden Sutton, Chester.
Cornwall: Ellbridge Experimental Station (C. E. Grainger), Hatt, Saltash.
T. H. Martin, Polborder, St. Mellion.
Devon: Devon County Agricultural Committee (D. Manning, Hort. Supt.), High Cross, Bere Alston, Devon.
G. H. Powell, Houndspool, Dawlish.
R. Wellington, Worth, Helo, Bradninch.
Dartington Hall, Ltd., Totnes.
Dorset: Bedford & Jesty, Bere Regis, Wareham.
R. Mann, No. 8 Colony, Kinson, West Howe.
Essex: W. Seabrook & Sons, Ltd., The Nurseries, Boreham, Chelmsford.
S. Macdonald, Little Baddow Hall, near Chelmsford.
W. Lawrence, Fruit Farm, Ashdon, Saffron Walden.
W. Digby & Son, Great Braxted, Witham.
Glos.: M. G. Ling, Kent's Green House, Taynton.
Hants: H. L. Allensby, Swanwick, Southampton.
F. W. Bowers, The Orchard, The Park, Park Gate, Southampton.
L. Cleeve, St. Cuthbert's Field, Park Gate, Southampton.
H. N. Collard, Liss.
A. J. Davenport, Tresco, Sarisbury Green, Southampton.
F. Dimmick, Crescent Road, Sarisbury, Southampton.
F. E. Dowland, Homeleigh Gardens, Bashley, New Milton.
E. W. Edwards, Brook Lane, Warsash.
J. O. Evans, Maytree Cottage, Bursledon, Southampton.
H. J. Everett, Ribnig Fruit Farm, Swanwick, Southampton.
G. E. Ferris, Brownwick Lane, Titchfield.
W. Fox, jun., "Rona," Dodwell, Bursledon, Southampton.
F. H. Freemantle, Moss Bank, Church Road, Locks Heath.
J. Hammond & Son, Stubbington Lane, Stubbington, Fareham.
Hants Co. Council Experimental Fruit Station, Botley. (C. J. Gleed, Hort. Supt.)
J. T. Lutman, Orchardleigh, Swanwick, Southampton.
R. Lutman, Elms Close, Swanwick, Southampton.
J. Luxton, Burgessland, Botley, Hants.
G. A. Merrett, Crescent Road, Locks Heath.
A. Musker, West End Inn, Titchfield, Hants.
C. J. Newbury, Yew Tree Farm, Warsash, Southampton.
W. A. Newbury & Sons, Sarisbury Green, Southampton.
H. Peagram, Rayne Cottage, Brook Lane, Sarisbury, Southampton.
W. A. Richards, Park Gate, Southampton.
A. E. Roberts, Frith Farm, Wickham.
W. Skinner, Friday Street Farm, Ide Hill, Sevenoaks.
B. Taylor, Tiptoe Fruit Farm, Hordle, Lymington.

J. Tilbury, Junr., Pylands, Bursledon, Southampton.
W. Turner, Brook Lane, Botley.
C. E. Wyatt, Brook Lane, Sarisbury, Southampton.
G. Bull, Curdridge, Botley.
R. L. Carnell, Shirrell Heath, near Botley.
Hereford: E. J. Hutton, Winthill Farm, Cradley, Malvern.
Kent: J. L. Barton, Broadwater, East Malling.
J. T. Coleman, Larchwood Farm, Seal, Sevenoaks.
The East Malling Research Station, East Malling.
Messrs. F. & T. Neame, Macknade, Faversham.
P. N. Wright, North Court, Chilham.
Horticultural College, Swanley, Kent.
Lincs.: H. Roughton, Spalding Road, Holbeach.
Norfolk: Daniels Bros. Ltd., Nurseries, Tunstead, Norwich.
A. B. Ringer, Mere House, Seething.
G. Smith, Walnut House, Upwell, Wisbech.
Salop: E. Nicholls, Weeping Cross, Cross Houses.
Somerset: A. E. Binning, Crown Hotel, Axbridge.
C. L. Gardner, Greystone House, Cheddar.
A. P. Grenfell, Old Manor, Stawell, Bridgwater.
C. Hoskins, Bradley Cross, Cheddar.
E. Leigh, Draycott, Cheddar.
Long Ashton Agric. & Hort. Research Station, Long Ashton, Bristol.
Mrs. D. Napier, F.R.H.S., & Miss M. K. Napier, Stepwater Nurseries, Taunton.
Miss E. Parrett, West View, Draycott, Cheddar.
H. J. Payne, Church Lane, Axbridge.
Sargent Bros., Widgetts Lane, Cheddar.
E. P. Small, Bradley Cross, Cheddar.
H. Wilson, Cheddar Road, Axbridge.
H. A. T. Male, Endicotts, Donyatt, Ilminster.
Suffolk: A. A. Geater, Gosbeck Hall, near Coddenham, Ipswich.
The Hollesley Bay Labour Colony, Hollesley, near Woodbridge.
Surrey: G. F. P. Smale, "Dentrills," Chobham, Woking.
Sussex: J. B. Fell, Hull's Farm, Pulborough.
R. B. Edmondson, Batchelors Hall, Isfield, Uckfield.
Worcs.: Messrs. T. & M. Dixon, Tardebigge, Bromsgrove.
J. H. A. Smith, Church Lench, Evesham.

National Mark Wheat Flour.—The tests made at the National Bakery School to determine the bread-making characteristics of National Mark All-English (Yeoman) and All-English (Plain) flours made from wheat of the 1929 crop have now been completed. The material for the tests was obtained from authorized millers in all parts of the country, 11 samples of All-English (Yeoman) flour and 10 samples of All-English (Plain) flour being supplied. Individual tests were carried out with each flour. In his report on the tests, the Director of the National Bakery School makes the following general observations :—

ALL-ENGLISH (YEOMAN)

(1) The average standard was higher than that of the samples obtained in 1929 (*i.e.*, before the National Mark Wheat Flour Scheme came into operation).

(2) Most of the samples will give satisfactory bread when worked on a 3-hour process, but some varieties are tougher and so require a longer process. On the average, a 4-hour process is recommended for all Yeoman-wheat flours. If the doughs do not appear properly fermented at the end of this time, a 6-hour process worked at 78° F. should be employed.

(3) All varieties of Yeoman flour are improved by the addition of oil or fat, and the use of at least one quart of oil or 3½ lb. of fat per sack is recommended in all processes.

(4) Doughs of medium consistency give most satisfactory results. Tight doughs give bread of inferior quality, poor in volume and poor in crumb. 14½ gallons of water per sack is a suitable average for all the flours, and doughs should not be worked below 78° F. nor above 82° F.

(5) One-pound tin loaves are recommended, since by this means loaves are produced with a small crumb surface which can be cut very easily without it breaking down during the process. Further, a better eating loaf can be obtained since a slightly greater (relative) volume can be aimed at.

ALL-ENGLISH (PLAIN)

(1) These flours are not so good for bread-making purposes as All-English (Yeoman), but although produced primarily for cake making, they could be used for bread-making where All-English (Yeoman) flour is not obtainable.

(2) Most of the flours produced very satisfactory bread on a 4-hour process, although several were sufficiently strong to stand a 5-hour process.

At the Annual Convention of the National Federation of Women's Institutes held at Blackpool, a resolution in favour of the use of the National Mark flour was carried unanimously by an audience of about 2,500 delegates from Women's Institutes in all parts of England and Wales.

At a Fête held at the Radcliffe Infirmary, the Oxfordshire County Branch of the National Farmers' Union had a stall for the sale of National Mark produce. National Mark flour, which was presented to the National Farmers' Union by the four Oxfordshire authorized millers, was packed in retail bags and sold under the National Mark at the Fête, a licence to pack flour for this occasion having been granted to the Secretary of the Oxfordshire County Branch of the National Farmers' Union by the National Mark Committee.

National Mark Canned Fruit, Peas and Beans.—The Minister has appointed a National Mark Canned Fruit Trade Committee to consider applications for permission to apply the National Mark to canned home-grown fruit and vegetables, to make recommendations thereon to the National Mark Committee, to consider reports regarding the application of the National Mark by canners and generally to advise the National Mark Committee and the Ministry in regard to the application of the Mark to canned home-grown fruit and vegetables.

The National Mark Canned Fruit Committee consists of :—

Sir Stanley Machin (Chairman),
Mr. F. Hirst (Chipping Campden Research Station),
Sir William Lobjoit (representing fruit growers),
Sir Edgar Jones and Mr. S. W. Smedley (representing canners),
Mr. W. Sprainger (wholesale distributor),
Mr. G. C. Salmon (representing consumers' co-operative societies),
Mr. H. S. Salmon (representing retail grocers),

together with one additional member, representative of fruit growers, who has yet to be appointed. The Secretary of the Committee is Mr. B. A. Tyson, of the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

The Trade Committee have held two meetings and recommended the issue of certificates of authorization to a number of applicants.

Publicity for National Mark Produce.—As part of a scheme of propaganda designed to increase the public appreciation of standard National Mark products, the Ministry is arranging for special "National Mark Weeks" to be held in a number of important towns in England and Wales during the next few months. A preliminary programme of publicity campaigns has been drawn up, which includes press, poster and public-vehicle advertising. Wherever possible, National Mark Weeks will be held concurrently with agricultural shows and trade exhibitions at which the Ministry is staging marketing demonstrations or exhibits ; in certain other cases, arrangements are being made to stage a National Mark Shop Exhibition for the Week. The centres at which such campaigns have already been arranged are as follows :—Torquay, Worcester, Burton upon Trent, Hastings, Epping and district, Llanelly, Smethwick, Folkestone, Tunbridge Wells and Leamington Spa ; while arrangements are well forward for campaigns at Barnstaple, Bedford, Cambridge, Hereford, Hull and Watford. At the Kent Show at Folkestone, the Sussex Show at Hastings, and the Tunbridge Wells and South-Eastern Counties Show at Tunbridge Wells, authorized packers of National Mark eggs, aided by small grants from the Ministry, are combining to stage demonstrations of egg testing, grading and packing. In London, arrangements have been made for advertisements to appear on omnibuses, for four weeks commencing on June 16, inviting the public to buy National Mark eggs, tomatoes, cucumbers and beef.

Authorized packers in the various National Mark schemes have been apprised of the Ministry's intentions with regard to publicity for National Mark produce, in order that they may

take the opportunity to offer supplies of National Mark products in the towns concerned.

Marketing Demonstrations.—Marketing demonstrations were staged during June as follows :—

Royal Counties Show, at Reading, June 4 to 7—National Mark Hall, Pigs and Cereals.
Three Counties Show, at Worcester, June 10 to 12—National Mark Hall, Pigs and Cereals.
Staffordshire Agricultural Show, at Burton upon Trent, June 18 & 19—National Mark Hall, Pigs and Cereals.
Sussex Show, at Hastings, June 25 & 26—Pigs and Fruit.

National Mark produce was displayed at the Essex Agricultural Show at Epping (June 11 & 12).

The Royal Counties Show at Reading.—Was there anything new? This is usually the first question interested people ask about an agricultural show. At the Royal Counties Show, held at Reading from June 4-7, there was a striking innovation —National Mark luncheons and teas were served in the N.F.U. tent.

A reduced version of the Ministry's new artistic poster now appearing on the hoardings—showing a herald whose red and blue garb is completed by a white tabard on which is emblazoned the National Mark design—announced the innovation. The main items on the menu were National Mark beef, National Mark flour in All-English bread, National Mark eggs, National Mark tomatoes and National Mark cucumbers.

Also new to the Royal Counties Show was the Ministry's rearranged National Mark Hall. Here, the various home-produced food-stuffs which have been brought under the "New Marketing" were displayed. People of all trades and occupations were attracted by the Ministry's stand, including farmers, food manufacturers, housewives and even cooking instructresses. It was undoubtedly one of the most popular displays in the Show. Bread made with All-English National Mark flour received more attention from visitors than any other exhibit.

Tour of Grocer-Students.—In the issues of this JOURNAL for January and August of last year, reference was made to a tour arranged by the Ministry for the benefit of grocer-students who secured the 17 highest places in the final examination of the Institute of Certificated Grocers. In the issue of the JOURNAL for November last year, one of these students recorded his experiences and impressions. The most casual reference to

that record conveys an idea of the valuable effect of the tour in instilling an interest in home produce.

It has been decided to arrange a similar tour this year, for the same number of students gaining the highest places in the 1930 final examination of the Institute. Commencing on July 7, the party will cover about 900 miles, and will study the home-production and marketing of eggs, bacon, hams, potted meat, flour, malt products, honey, cheese, fresh and condensed milk, cider and canned fruit and vegetables. In addition, a visit will be made to the Royal Agricultural Society of England's Show, to be held this year at Manchester.

Standardization : Effect on Physical Markets.*—It is interesting to consider the possible effect of a widespread extension of the National Mark movement on the markets themselves. The lack of standardization has been one of the reasons why markets have been essential in the past—sellers have been under the necessity of taking their produce in bulk to markets to be scrutinized by potential buyers. There is, however, no reason to believe that the big markets of the country will lose their function. Among the most standardized commodities—if we may use the terms—in commerce, are stocks and shares, and here practically all transactions are conducted in centralized exchanges. The concourse of buyers and sellers provided by a big market is essential to the free working of demand and supply, altogether apart from any question of physical convenience. Moreover, agricultural produce can never be absolutely standardized as can manufactured articles; some inspection, even if only of samples, will always be needed. To some extent, there are likely to be changes, however. Possibly, some of the small markets may drop out, while, with the development of packing stations, the country produce markets are likely to serve less and less as assembly points for produce and to be limited to supplying the needs of local shopkeepers and consumers. In the case of the large markets in consuming centres, there is already a tendency for them to be used largely as sample showrooms, in which the buyer meets the vendor and the actual buying and selling takes place, delivery being taken from warehouses, which may either form part of the market or may be grouped in its vicinity. The exchanges for imported fruit which operate in a number of ports are perhaps the most advanced form of this development.

* From an Address by Mr. A. W. Street, C.I.E., M.C., Assistant-Secretary of the Ministry of Agriculture and Fisheries, to the Eleventh Annual Conference of Midland Market Authorities on May 20, 1930.

The growth of standardization will encourage this tendency. It will make for more efficient operation of markets. Handling of produce will be reduced, traffic congestion around markets will be eliminated, and space will be available for a larger number of traders in the markets.

Out of the beef grading scheme, it is possible that, in time, a new method of marketing fat cattle may materialize which may affect, in some degree, the importance of the existing livestock markets, particularly the smaller markets. At present, a very large proportion of the fat cattle produced in this country is marketed, by the producer, through the livestock markets. The introduction of a system of carcass grading by impartial graders, however, makes possible an alternative method of sale, viz., direct consignment of cattle by producers to assembly points in large consuming centres, there to be slaughtered in the public abattoirs, graded in carcass form and sold by dead weight. Experiments in the practical working of this method of sale are at present being carried out. Should the method prove feasible—and there is no reason to think that it will not—it will afford the producer direct access to a relatively stable market for his beef. As a result, decreased use of the small livestock markets might be expected. These markets, with their limited business, are sensitive to comparatively minor variations in supply or demand; the number of buyers being small, free competition is less likely than in large markets. An element of speculation is, in fact, always present in operations in markets of this type, and this would be eliminated by the use of the alternative method of direct consignment to the carcass grading and consuming centre. The larger markets in producing districts, such as Norwich or Exeter, would probably be less affected; their large turnover ensures for them a reasonable measure of stability. The functions of the big town livestock markets, where still existing, would be transferred to the public abattoir and the wholesale meat market. Economically, this would be a gain. If it is possible, by direct consignment to the abattoir, to avoid exposing in open market large numbers of finished cattle, most of which are afterwards taken to the local abattoir for slaughter, so much the better. The development of any such marketing system pre-supposes the extension of centralized slaughtering which has long been strongly advocated by various responsible bodies. In this connexion, it is worth mentioning that under the Development (Loan Guarantees and Grants) Act of 1929, grants from Government funds can

now be made, in suitable cases, in aid of the cost of providing public slaughtering facilities.

Standardization in Western Australia.—The extension of compulsory standardization of agricultural produce in overseas countries, which has been a feature of modern marketing developments, is exemplified by the passing, last November, of the *Agricultural Products Act* of Western Australia. This Act provides that, under a maximum penalty of £20, no agricultural, farm, orchard, garden, or dairy produce may be sold or offered for sale unless graded, stacked and marked, if sold loose, or unless graded and packed, if sold in packages, according to prescribed regulations. Such practices as "facing" the lot with produce of superior quality are guarded against by the provision that all produce offered for sale must be so packed or stacked that the outer surface of each lot gives a true indication of the average size, nature and quality of the lot as a whole. Provision is made in the Act for Government inspection of produce for the purpose of enforcing the Act.

Danish Committee on Marketing.—The Danish Government Committee on Marketing has recently published a report dealing with the marketing of Danish agricultural produce. This report refers to the growing competition from foreign countries and emphasizes the danger inherent in the position of almost complete dependence on the British and German markets into which Danish agriculture has drifted by circumstances. Danish producers are warned that other countries are striving to overtake Denmark in a race for export business and that steps must be taken not only to retain old markets, but to find new outlets and to endeavour as far as possible to diversify production. The report deals with three main classes of produce—dairy produce, eggs and bacon.

Dairy Produce.—As regards dairy produce, one of the main conclusions arrived at is that the utilization of milk, based as it is almost entirely on butter making, is too one-sided, and, in view of the enormous increase in the output of milk from year to year, is liable to encourage waste. Less milk should be used for pig-feeding and far more in establishing profitable trade in new export commodities, such as cheese and tinned milk.

New packing methods are suggested as a novel feature for stimulating the export of butter. Inquiries show that in many parts of the world the retail butter trade is evincing a preference for butter packed in small quantities ready for distribution, and producers who have responded to the demand have experienced an increase in sales. The question of devising suitable packing may present difficulties on account of the perishable nature of butter, risk of spoiling its flavour, and so forth, but if the difficulties could be overcome, the results would more than compensate for the initial outlay in equipping a modern packing

plant. The South of England generally, and London in particular, as well as large towns in South Germany, France, Belgium, Switzerland, and even in America, all offer good markets for packed butter, consumers there being ready to pay a good price, once they are assured of receiving a brand that is of good uniform quality.

In general, purchasers and export firms ought to join forces in the systematic development of foreign markets. They should establish distributive offices and agencies and open propaganda shops in selected markets for the demonstration and sale of Danish "Lur-mark" butter in tasteful retail packing. Much more could be done than is being done at present in the direction of commercial advertising.

The report considers the possibility of further developing the export of Danish cheese, which at present is not extensive. Before this trade can be developed, Danish producers must improve the quality of their produce, and this could be done by the adoption of the low pasteurization method. Storing rooms for the common use of cheese producers should be set up, on the lines of those in Holland and Switzerland, for storing the cheese after production. Such co-operation would induce a uniformity of quality, the absence of which now hinders export. Further, control should not be limited to the checking of the fat content, but should be extended to deal with flavour, appearance, packing, etc. Concentration on the export of processed cheese is recommended.

The report states that there is also room for the expansion of the tinned milk industry and that this should not be difficult to achieve as Danish factories have already established a reputation for their product.

Eggs.—Inquiries have convinced the committee that a continuance of foreign competition is likely to reduce the profits of egg production. The measures which, in the committee's view, should be taken to enable Danish producers to hold their own, include increasing the egg yield and the production of table poultry for export. The egg-control should be extended to reach back to the producer, so as to ensure the delivery of only the best possible quality of eggs to the members' export organizations; and the authorities should stimulate production by granting funds for disseminating knowledge as to improved methods of breeding, and should set up incubator plants where producers could secure supplies of good pedigree stock. There is also considered to be a need for centres where poultry could be killed, graded and packed.

Bacon.—Fears are expressed that the present dependence of the Danish pig industry on a few principal export markets is highly dangerous and should be remedied by seeking new outlets and by diversifying production. The variations in the quality of bacon available for export from time to time is stated to be harmful. The National Pig Census, which is now taken annually, should be taken at more frequent intervals, and this, together with other information of the same nature, should be issued regularly to the farmers who would thus be kept informed of the rate of delivery of pigs to the slaughterhouses. Finally, the control which is now exercised by the Danish Ministry of Agriculture should be tightened and extended.

Marketing Organization Abroad: Norway and Holland.—*Norway.*—A feature of recent legislation, in certain overseas countries, for the purpose of improving agricultural marketing methods, is the establishment of non-trading Boards, charged with the function of regulating the marketing of specified commodities.

An example of this tendency is provided in a resolution of the Norwegian Cabinet Council, on May 2, 1930, to advance legislation with the object of encouraging the marketing of bacon, milk, cheese and butter. For this purpose it is proposed to establish a Marketing Council, consisting of five members, two nominated by the National Federation of Norwegian Milk Producers, two by a projected National Organization of Bacon Producers, and one by the Royal Society for the Welfare of Norway.

In order to provide the Council with the necessary funds, it is proposed that the Government, on the recommendation of the Council, shall be empowered to impose a levy, for one year at a time, on home-produced pigs and milk. In the case of pigs, the levy will be payable by the person who offers a pig for inspection by a municipal meat controller; in the case of milk, it will be payable by any person delivering milk to a dairy, condensing factory, cheese factory, milk sales club or other business which markets milk received direct from a producer.

Holland.—Another example of this tendency is furnished by a Netherlands Ministerial Decree of April 5, 1930—to come into force at a date to be determined later—containing regulations for applying Clause VII of the Act of May 31, 1929 (being an Act to regulate the export of agricultural, horticultural, cattle-breeding and dairy products), to the inspection and marking of bacon. For the purposes of recognition by the Netherlands Government, a bacon control association must be a corporate body, regulated by rules approved by the Minister of Agriculture, who also has the right to appoint an advisory member of the management and to approve the appointment of the Chairman and other independent members, the latter apparently constituting at least one-half of the board of management.

Members admitted to affiliation in a bacon control association must be responsible bacon curers, but affiliation can be refused without giving reasons. Suspension and fine can be imposed upon a member for infraction of the rules. Provision is made for the appointment of a Board of Appeal, appointed by the Minister after consultation with the bacon control stations, and its awards are to be binding on the managements.

The requirements in regard to preparation, quality, grading and packing of the produce, and also the regulations for inspection, must be formulated by the control station, with the approval of the Minister, who must also approve before issue any information intended for publication.

of the larger packages provided for in the scheme should certainly be avoided as far as possible for the more tender varieties of black cherries. After consultation with the various interests concerned, grade designations and definitions of quality as set out in Table I have been agreed upon for home-produced cherries.

These designations and definitions are given statutory effect in the Agricultural Produce (Grading and Marking) (Cherries) Regulations, 1930.* Briefly, the regulations prescribe two grades—"Extra Selected" and "Selected"—based on size and colour. The statutory grade designations refer only to cherries grown in England and Wales.

Standard packs and packages, which are required to be used with these grades when the National Mark is applied, are given in Tables II and III.

Only cherries produced in England and Wales may be packed under the National Mark.

No person may mark any article, covering or label with a statutory grade designation mark (*i.e.*, the National Mark) unless authorized to do so by or under regulations made under the Act, and such authorization can only be granted, revoked or suspended by the National Mark Committee which has been appointed by the Minister of Agriculture and Fisheries for that purpose.

Procedure and Conditions to be Observed by Packers Authorized to apply the National Mark

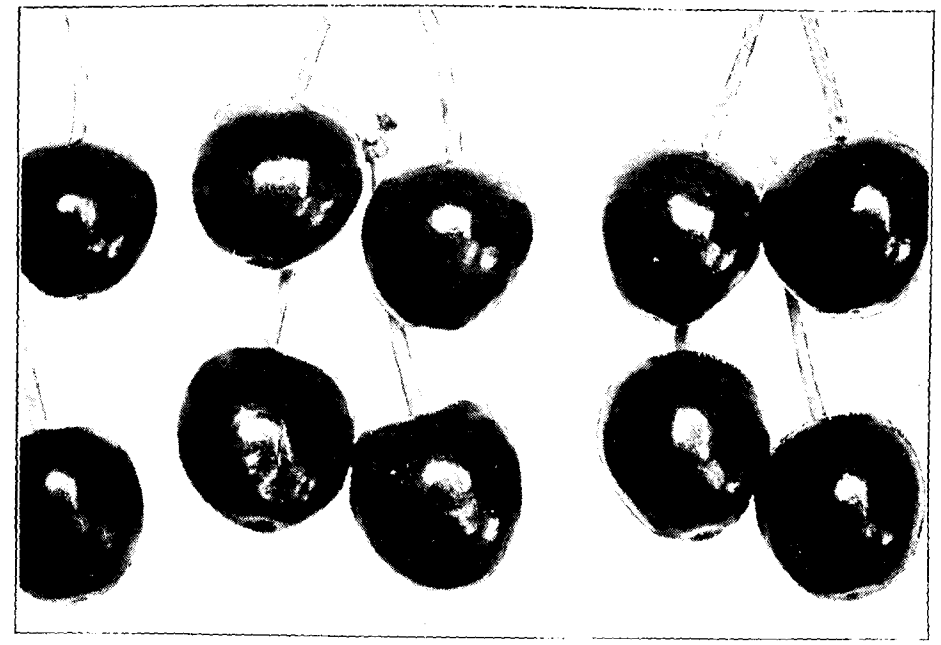
(a) *Output.*—In the first year, permission to apply the Mark will only be granted to growers or packers with an anticipated output of not less than five tons.

(b) *Grading.*—Authorized packers may only apply the National Mark to fruit grown in England and Wales which complies with the definitions of quality prescribed for the grade designations. (See Table I.)

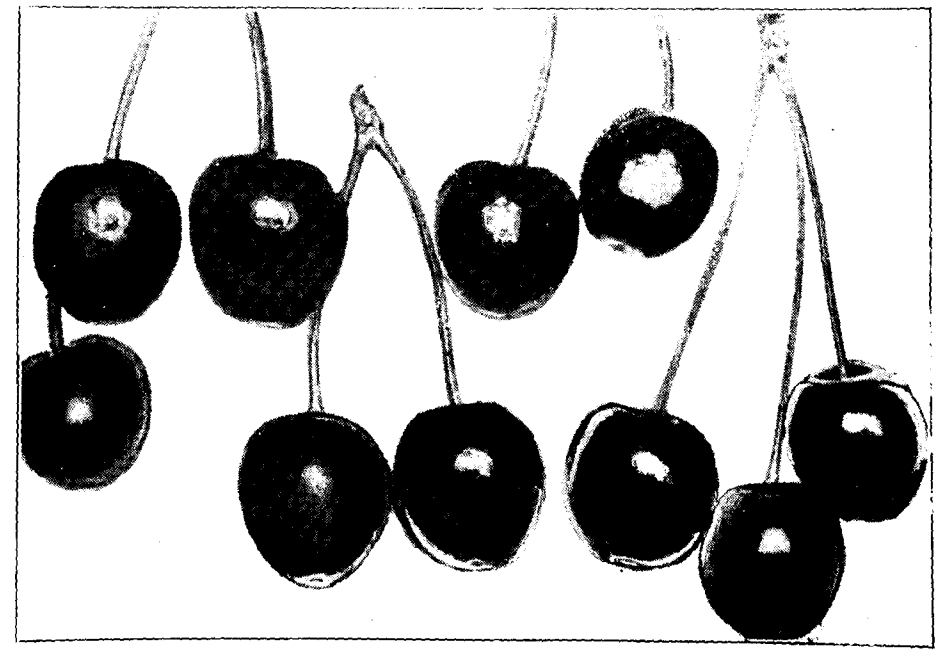
(c) *Packing.*—The method of packing the contents of each package to which a National Mark label is applied must conform to the details specified in Table II, and the package must conform to the dimensions and capacity specified in Table III.

(d) *Use of National Mark Labels or Covers.*—Authorized packers may use only the official National Mark labels or covers; these will be issued to authorized packers, on payment,

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2.



"Extra Selected" Grade. Each cherry to measure not less than $\frac{3}{4}$-inch in diameter.



"Selected" Grade. Each cherry to measure not less than $\frac{11}{16}$-inch in diameter.

NOTE. "Selected" grade may include cherries which fulfil the requirements of "Extra Selected" grade.

NATIONAL MARK CHERRIES (see p. 368 and Table I, p. 369).

To face page 368.

The rules must contain provisions for guaranteeing the correct application of the Government Marks, and the management can demand a bank guarantee in its own name from each affiliated member, the amounts of such guarantees to be approved by the Minister. Marks which have been improperly applied to bacon that is still within the Dutch frontiers may, on detection, be removed at the cost of the delinquent.

Loans to Co-operative Marketing Enterprises.—As a step to encourage the development of co-operative marketing of agricultural produce, the conditions under which the Ministry of Agriculture and Fisheries is authorized to make loans to co-operative marketing enterprises have recently been modified so as to provide an alternative method of repayment of a loan which will be less burdensome to a society in the early years of a loan. Payment may, in future, be made by either of the following methods :—

A. Equal half-yearly repayments of principal, together with interest on the principal outstanding ; or

B. Half-yearly payments on a sliding scale under which the *first* repayment of capital and interest is the minimum and is equivalent to the amount of the *last* repayment of capital and interest under Method A above, subsequent half-yearly payments forming a uniformly increasing series calculated according to a prescribed formula.

In consequence of the slightly heavier charges for interest the total amount repaid under Method B would be slightly larger than under Method A, but Method B has the advantage of postponing the heavier payments until the latter part of the loan period, when the state of a society's finances should normally enable it more easily to bear the burden.

The conditions have also been eased to the extent that the initial period of remission of interest on a loan may be extended, on the recommendation of the Ministry's Advisory Committee on Co-operation and Credit, from two up to five years.

Copies of a leaflet (Marketing Leaflet No. 19), which contains the conditions of the loan scheme, may be obtained, post free, from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

Pig Industry Council.—Owing to the pressure of his other engagements, Mr. Ernest R. Debenham, who has been Chairman of the Pig Industry Council since it was constituted in 1928, has resigned the Chairmanship of the Council. The Minister of Agriculture has regretfully accepted Mr. Debenham's resignation and has appointed the Viscount Folkestone, the present Vice-Chairman of the Council, to be Chairman in succession to Mr. Debenham.

NATIONAL MARK SCHEME FOR CHERRIES

MANY growers of cherries market their crop graded and packed in such a manner as to command the best prices on the markets, but the majority do not. The present irregularity, both of produce and weights, causes uncertainty and dissatisfaction in the markets and loss to all concerned. For many years, the principal organizations of retail fruiterers have, in fact, complained regarding the unsatisfactory grading and packing of English cherries and the irregularity of the weights packed, and, in particular, have recommended that a declaration of weight should be required on every container of cherries sent to market. More recently, the National Farmers' Union has had the position under consideration and has now collaborated with the Ministry in preparing a scheme, under the Agricultural Produce (Grading and Marking) Act, 1928, for the grading and packing of cherries in association with the National Mark. The present scheme, which came into operation on June 18, 1930, is the result.

National Mark schemes are in operation for other home-grown fruits, namely, apples, pears, tomatoes, cucumbers and strawberries, and the action that is now being taken with regard to cherries is part of the wider programme that has already proved successful for other commodities.

The competition of foreign supplies, especially of early fruit, is a consideration of great importance, as imports of fresh cherries represent a large proportion of the total supplies. The introduction of a National Mark scheme will enable home-grown cherries to be offered under a guarantee of home origin as well as of weight and quality, and thus facilitate the preferential buying of home-grown fruit with corresponding benefit to the home grower.

Although, in order to meet the needs of a section of the trade, the use of returnable strike and half-sieve baskets is provided for in the scheme, the modern demand for smaller units of sale, coupled with the need for rapidity in distribution, is leading to the extensive use of punnets and chip baskets for the packing of soft fruits. For high quality, tender-flesh varieties, the smaller unit undoubtedly ensures safer transit. In hot weather, when cherries are ripening rapidly, there is frequently considerable crushing in the lower part of the package when containers holding 24 lb. of fruit are used, and soft-flesh cherries will not withstand the bruising which is bound to occur. Blemished cherries rot quickly, and the use

TABLE I.—CHERRIES PRODUCED IN ENGLAND AND WALES—GRADE DESIGNATIONS AND STATUTORY DEFINITIONS

Grade Designation	Statutory Definitions of Quality*			
	Size	Colour	Condition	Blemish
Extra Selected.	Largest size of the variety. Each fruit to measure not less than $\frac{7}{8}$ inch in diameter.	Black varieties to be coloured dark red or black. White varieties to be coloured yellow over whole surface with red flush.	All fruit when packed to be firm and have reached a stage of maturity which will normally ensure full ripeness at the time of retail sale.	All fruit to be free from blemish cracks and malformation, to be completely developed and to have stalks.
Selected	Each fruit to measure not less than 11-16 inch in diameter.	Each fruit to have not less than three-quarters of surface coloured as defined for "Extra Selected" grade.		

* The statutory definitions relate to the fruit at the time of packing.

TABLE II.—STANDARD METHODS OF PACKING TO BE EMPLOYED WHEN GRADE DESIGNATION MARKS ARE APPLIED TO CHERRIES

Grade Designation	Package.	Lining Paper and Packing Material.	Size, Range and Colour of Fruit	Declaration of Contents.
Extra Selected.	Nos. 1 and 2 punnets. No. 2 chip baskets. (*Non-returnables.*)	No lining for punnets. For chip baskets blue lining paper may be used.	Colour and size to be uniform.	Contents to be declared by net weight and to be in weights of 1 lb., 2 lb., 3 lb., 4 lb., 6 lb., 12 lb. and 24 lb. according to capacity of package.
Selected.	Nos. 1 and 2 punnets. Nos. 3, 4, 6 and 12 chip baskets. Nos. 3 and 4 veneer boxes. No. 2 chip bonnets. 12 lb. veneer trays. (*Non-returnables.*) Strikes. Half-sieves. (*Returnables.*)	No lining for punnets. For chip baskets and bonnets blue lining paper may be used. For strikes, half-sieves, and veneer boxes and trays, blue lining paper must be used.	Normal size variation for the variety of cherry, but excluding very small fruits.	

by the National Farmers' Union, on behalf of the Ministry of Agriculture and Fisheries. Labels may not be obtained from any other source, are not transferable, and care must be taken by packers to prevent them from getting into the hands of unauthorized persons.

Each package must bear the kind of label approved by the Ministry for that type of container. The quality of the contents of each package to which a label is applied must conform to the statutory definitions set out in Table I according to the grade designation appearing on the label.

Labels which take the form of covers must be used for chip baskets, strip labels for punnets, and tie-on labels for half-sieves, strikes, bonnets, veneer boxes and trays. They will be coloured blue for "Extra Selected" and red for "Selected," and bear the grade designation and the net weight of the package, with a space for insertion of the salesman's name and address. Before issue, they will be over-printed with the name or mark of the authorized packer.

(e) *General.*—An authorized packer must allow his premises, equipment and records to be inspected at any reasonable time by any officer of the Ministry of Agriculture and Fisheries authorized in that behalf, and must allow such officer to open and inspect, on the premises either of the authorized packer or of his market-agent, any package put up by such authorized packer and bearing a National Mark label or cover, and to remove the National Mark label or cover from any package the contents of which in the opinion of such officer do not comply with the definition of the statutory grade designation appearing on the National Mark label or cover, or do not accord with the weight thereon declared.

TABLE III.—PACKAGES TO BE EMPLOYED WHEN GRADE DESIGNATION MARKS ARE APPLIED TO CHERRIES

PACKAGES

(All dimensions are internal.) (Imperial Bushel = 2219·360 c. in.)

RETURNABLE

Name	Dimensions in inches			Capacity in cubic inches		Weight of Fruit
	Diameter	Depth at side	Depth at middle	Standard	Variation	
Strike ..	11¾	6¾	5¾	763	30	12 lb.
Half-sieve ..	14½	9	7½	1,456	50	24 lb.

NON-RETURNABLE

Chip or Wax-Paper Punnets

No. 1 Rectangular, Contents 75 c.in., weight of fruit 1 lb.
No. 2 do. do. 160 do. do. 2 lb.

Chip Baskets (With Handles)

Name	Dimensions in inches			Standard Capacity (minimum)	Weight of Fruit
	Bottom	Top	Side		
No. 2 taper ..	$7\frac{3}{4} \times 5\frac{1}{8}$	$9\frac{1}{2} \times 5\frac{3}{4}$	$3\frac{1}{4}$	150 cu. in.	2 lb.
No. 2 square ..	$8\frac{3}{4} \times 5\frac{1}{2}$	$8\frac{3}{4} \times 5\frac{1}{2}$	$3\frac{1}{8}$	150 cu. in.	2 lb.
No. 3 taper ..	$8\frac{3}{4} \times 5\frac{3}{8}$	$10\frac{1}{2} \times 6\frac{1}{4}$	$3\frac{11}{16}$	200 cu. in.	3 lb.
No. 3 square ..	$9\frac{1}{2} \times 6\frac{1}{8}$	$9\frac{1}{2} \times 6\frac{1}{8}$	$3\frac{1}{2}$	200 cu. in.	3 lb.
No. 4 taper ..	$9\frac{3}{4} \times 6\frac{1}{8}$	$11\frac{1}{2} \times 7\frac{1}{2}$	$3\frac{3}{4}$	250 cu. in.	4 lb.
No. 4 square ..	$10 \times 6\frac{7}{8}$	$10 \times 6\frac{7}{8}$	$3\frac{3}{4}$	250 cu. in.	4 lb.
No. 6 taper ..	$11 \times 6\frac{1}{8}$	$13 \times 7\frac{5}{8}$	$4\frac{1}{2}$	370 cu. in.	6 lb.
No. 12 taper ..	$13\frac{3}{4} \times 7$	$15\frac{1}{4} \times 8\frac{1}{4}$	6	670 cu. in.	12 lb.

Bottom and side measurements taken from scoring; top measurements are average widths and lengths inside binder.

Chip Bonnets

Size	Hitherto known as	Diameter in in.		Average depth in inches	Contents in cu. in.	Weight of Fruit
		Top	Bottom			
No. 2 ..	$\frac{1}{4}$ bushel	$12\frac{3}{4}$	11	$5\frac{7}{8}$	655	12 lb.

Veneer Boxes and Tray

Size	Hitherto known as	Internal Dimensions in inches	Contents in cu. in.	Weight of Fruit
No. 3	12-lb. box	$13 \times 8\frac{1}{4} \times 6\frac{1}{4}$	670	12 lb.
No. 4	6-lb box	$10\frac{1}{2} \times 7\frac{3}{8} \times 4\frac{3}{4}$	367	6 lb.
No. 12	12-lb. tray	$16\frac{1}{4} \times 11\frac{1}{4} \times 3\frac{1}{2}$	640	12 lb.

NOTE.—Copies of the leaflet (Marketing Leaflet No. 21) describing the National Mark Cherries Scheme in detail may be had, free, on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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COUNCIL OF AGRICULTURE FOR ENGLAND

THE thirty-third meeting of the Council was held on Friday, May 30, 1930, at the Middlesex Guildhall, Westminster. *Mr. Denton Woodhead*, on the motion of *Mr. (now Sir) George Edwards*, seconded by *Mr. John Beard*, was unanimously elected Chairman for the ensuing year in the place of *the Right Hon. Lord Strachie* (Somerset), whose year of office then terminated. A very hearty vote of thanks was passed to Lord Strachie for his conduct of the Council's proceedings, and Lord Strachie replied thanking the Council.

A vote of sympathy and condolence with his relatives on the death of the Hon. Edward Strutt was passed, all members of the Council standing in their places.

The Minister's Statement.—*The Minister of Agriculture (the Rt. Hon. Noel Buxton, M.P.)* said he would like, in the first place, to emphasize how closely he and the whole Department attended to the recommendations and reports of the Council. He proposed to comment verbally upon those passed at the last meeting of the Council (February 6, 1930). As regards the Grading of Milk under the Ministry of Health Regulations, that subject would shortly be before the Council in a Report from the Standing Committee. The progress Report on the Better Marketing of Home-Grown Produce had been warmly welcomed by the Ministry, and printed and widely circulated by it. As regards the Report on the Supply of Home-fed Meat to the Forces, that subject had been again carefully gone into, but the Government had not found itself able to alter its previous decision. As regards Wheat Flour for the Forces, the Minister for War had agreed that tenders for National Mark flour should be called for in connexion with contracts made at stations where there were Army or Air Force bakeries for purposes other than bread-making; contracts were also to be called for from all stations where there were no bakeries; thus a very large trade might be secured. Coming to the Report to assist Veterinary Education and the Royal Veterinary College, he had recently announced in the House that the Treasury had agreed to a grant of £100,000. One of the conditions attaching to the grant was that a similar sum should be provided from other sources. The Council's suggestion for legislation to eliminate the scrub bull was one to which the Ministry had given much attention, and it was now endeavouring to obtain agreement between the various bodies interested. The potato situation had been helped as much as possible, and some account of what the Ministry

had done was in the Report of the Standing Committee now before the Council.

The Minister added that a serious position had arisen within the last few days as regards graded beef at the Birmingham Market. He informed the Council that the wholesale meat salesmen at Birmingham had decided to boycott National Mark beef in the Corporation's Market, and that the position called for as forcible action as the Ministry could take. They were making it impossible for retail traders to secure graded beef, except at much inconvenience, and, if their decision was adhered to, there would be no alternative but to limit the grading and marking of beef to the slaughterhouses of the industrial co-operative societies and private traders. The boycott had to be resisted with all the Ministry's strength, as it was an organized step to deprive producers of high-class beef of the proper reward for the reputation that was due to them, and was also a blow struck against the butcher who welcomed the scheme as a guarantee of high-class beef. The National Mark stood for true and fair play, both for the producer and for the consumer.

Mr. W. W. Sampson, J.P. (Dorset), thanked the Minister for the explanations he had given as to the effect of the reports and resolutions at the last Council Meeting. He would like further to suggest that an annual printed report should be issued which would be useful to members on their County Agricultural Committees. He regretted that the Minister had not been able to give any hope of the Government doing something to assist arable farming.

Sir Arthur Hazlerigg, Bart. (Leicester), said he wished to thank the Minister for obtaining the grant for the Royal Veterinary College, and he would like to know what voluntary sources of money the Treasury had in mind for the other £100,000. If this sum were forthcoming, there was still at least £50,000 needed to complete the new scheme. He would ask the Minister to persuade the Treasury to give a larger grant, as the matter was one of extreme urgency.

Mr. H. W. Thomas (Hants) asked for further information as regards the Agricultural Conference which the Government had called together, and which had recently presented an Interim Report. He was sorry that the Government had turned down the suggestion of Home-fed Meat for the Forces which this Council had put forward.

Mr. W. Holmes asked whether the Royal Veterinary College was a private institution run for profit.

The Minister replied that there were practical difficulties in the way of the issue of a printed report on the Ministry's actions on Council reports and resolutions. As to the Royal Veterinary College, the suggestion was that private persons might respond to the appeal. The College was a semi-public institution which raised a large part of its revenue from private sources. It was assisted to some extent by public funds: the College was certainly not run for private profit. He thought it was proper that the burden should be shared by public and private benefactors. As regards Agricultural Policy, he would like to be allowed, though out of order, to say a word or two about the Conference. It was not a fact that the Conference had been able to come to a unanimous decision on any definite proposal. It agreed upon a general expression of views, and desired to assist the cereal areas, but when it came to plans there was no agreement. That fact illustrated the difficulty that any Government must find in arriving at precise proposals.

The Chairman expressed the Council's thanks for the information which the Minister had given the Council, and assured him that he would have its unanimous support in trying to break down the Birmingham boycott.

Grading of Milk for Sale.—*Major Fawkes* (Yorks, W.R.) moved the adoption of the Report of the Standing Committee on the Grading of Milk for Sale (see Appendix I, page 382). He said that there were several possible alternative improved names for the grades. "Grade A" milk was, quite erroneously, often thought to be the top grade. The Standing Committee did not agree with the persons who wished that only tuberculin tested or pasteurized milk should be on the market. That was not practicable at the present time. The suggestion to give statutory powers to urban authorities with populations of 50,000 and over to require non-tuberculin tested milk to be pasteurized was a long step ahead. The object of grading was to improve the quality and good name of liquid milk in order that the public should realize its great food value, especially from the children's point of view. With increased confidence in milk would come an increased demand. Children with a pint or so of good milk per day become more energetic, keener about their work and games than other children, and would not get ailments so easily, or, when they did get them, would shake them off more quickly. The Standing Committee had been told that proper pasteurization did not affect the vita

min content of milk nor its general food value. Milk pasteurized a second time deteriorated more quickly than ordinarily, and the great danger was to have pasteurization done inefficiently on unlicensed premises. Bottling was another matter which required stricter regulation.

Mr. Charles Roberts (Cumb), as the mover of the Resolution on which the Committee had acted, expressed thanks for the Report now presented. The question of grading was very difficult, and the nomenclature suggested by the Committee, although not his own, he would readily accept, as he saw many advantages in it. It was probably better to clear the present grade names right out of the way and get out of the present atmosphere of mystification. The grades suggested would also work in with a National Mark Grading Scheme. He thought that if "Grade A" were called "Standard," it would have the effect of inducing all purchasers to try and produce "Standard" milk, and in that way milk quality would be improved. He did not think that the pioneers of grading would be interfered with by the alteration. The "Grade A" and "Certified" people each had their clientèle. He was doubtful about pasteurization and was there at a slight difference with Major Fawkes. As to fees, he would rather charge them to those who did not produce graded milk. He asked anyone who realized the importance of grading to try and get this clear and logical system into operation. *General Clifton Brown, M.P.* (West Sussex), congratulated the Standing Committee on their interesting Report. He thought the most important thing was the confidence of the public. Those who made alarming reports of the presence of tuberculosis in herds should be contradicted. *Mr. W. W. Sampson* asked whether the grades could not be further reduced in number, and whether it was true that the Ministry granted licences for some of the grades and the Local Authority for others, and could the licences be placed under one authority. *Mr. W. Lawson, M.B.E.*, also thought the number of grades might be reduced. "Special" and "Standard" would be the only ones required, and it would be a mistake to lower the standard of Grade A milk by increasing the 200,000 per c.c. count. It was better to concentrate on the production of high-grade raw milk than to put into operation a compulsory requirement for pasteurization, a measure which would hit the small produce-retailer. *Mr. Clement Smith* (East Sussex) said that such a requirement would force the producer-retailer to combine, and might effect good by doing away with the

unequal times of milking, *i.e.*, varying times in the morning and usually very early in the afternoon in order to deliver that day. *Mr. Robert Hobbs* (Wilts) thought the proposals of the Standing Committee would be a great improvement. He thought that the costs of tuberculin tests stood very largely in the way of farmers clearing their herds of the disease. A farmer could get through a test with, say, from 10 per cent. to 15 per cent. of reactors which had to be eliminated, and at a cost of the test of anything from £5 to £30. If he had 30 to 40 per cent. reactors, he would be hard hit, and, under present conditions, would be better off if he had left his herd alone. Farmers tried to realize that Government could not compensate for the destruction of reactors, but he thought the least it could do would be to give facilities for a free test of every animal. *Dr. Addison, M.P.*, Parliamentary Secretary of the Ministry, said that he had been asked by the Minister to comment upon the Report. He was delighted with its suggestion for a rational nomenclature. He agreed with Major Fawkes that the big issue was to increase the consumption of liquid milk, and in this connexion, the experiments on nutritional value now being carried out in Lanark should prove a good guide. Personally, he was glad that the Committee had taken the line they had on pasteurized milk. He thought that if we waited until the specialists had finished their disputes, no policy would be settled at all. Even if pasteurization did damage the milk a little, a greater confidence would mean that multitudes of children would be benefited by taking some milk rather than none at all. The Ministry would consider the whole Report without delay, and at a later Council meeting state what progress it had been possible to make.

Major Fawkes, in winding up the debate, said that, speaking for himself, he hoped that it would be possible before long to eliminate Grade A (T.T.) though he did not think it could be done at present. It was necessary to proceed step by step. He sympathized with the producer-retailer, and here again he would be careful not to inflict hardship upon them.

The Report was then received and adopted.

Marketing of Dressed Poultry.—*Lady Mabel Smith* presented a Report on the Marketing of Dressed Poultry (see Appendix II, page 385). She said she did so after having returned that morning from a tour in Germany, Austria and Switzerland, where she noted the large part taken by poultry in providing food for the people of the Continent. English poultry was the

best in any country, and the average of consumption, one per head per annum, was an insignificant figure. More should be done by poultry farmers to have their birds ready for the spring demand, which was quite a large one, and also for the autumn demand when additional poultry were cold stored.

The Minister, who then spoke, said that there were two points he would like to make about the Report. First, that there were technical difficulties in regard to the up-to-date packing plants required, and they should be careful not to go ahead too fast; and second, that the need of the present National Mark Scheme was shown by the fact that prices were not nearly sufficiently within the means of the masses. It was gratifying to the Ministry to know that, when the World Poultry Congress met this year, it would be noticed that an extraordinary change had come over English poultry marketing, and that our backs had at last been turned on hugger-mugger methods.

The Report was then received and adopted.

The Law Relating to the Sale of Milk.—*Mr. Clement Smith* moved the adoption of the Standing Committee's Report of the Law relating to the Sale of Milk (see Appendix III, p. 386). He said that he had been in the milk business for 40 years and had sold millions of gallons of milk. Although the law was very difficult and unfair, he had only been prosecuted once, and then had proved his innocence, but it had cost him £10 to do it. He drew attention to the differences on analysis between the morning and afternoon milk from many cows, and argued the case for the alteration of the law closely, referring the Council to the careful proposals of the Report itself. *Mr. James Hamilton* (Lancs) strongly supported the proposal, and *Mr. Charles Roberts* agreed that it was high time the position was corrected. Taking the reports on the milk yields at the Harrogate R.A.S.E. Show in 1929, with 70 cows competing, 17 produced milk below standard. The owners of these cows were, in the eyes of the law, prospective criminals guilty of fraud. *Dr. Addison* said that the Ministry concurred in the view that the present law was unfair. All he could say at this stage was that the Report would be brought to the notice of the Ministry of Health with a view to seeing how far action could be taken in accordance with the spirit of the representation.

The Report was then received and adopted.

The Potato Position.—*Sir Arthur Hazelrigg, Bart.* (Leics), moved the adoption of the Report of the Standing Committee on the Potato Position (see Appendix IV, page 391). The Report, he said, was short and self-explanatory. The Standing Committee had done what it could at the time, and had left the future in the hands of the Committee of representatives of the industry now sitting. *Mr. Cecil Robinson* (Holland) said he was sorry that nothing had been done to find out the best ways and means of disposing of the surplus crop of potatoes. The loss to growers last year was over half a million pounds sterling. If potato imports were not to be restricted, then the farmer should have a guaranteed price for wheat, which would solve all the other difficulties. In the Holland Division very high rents were paid for potato land, and potatoes were the big paying crop. He still hoped that the Government could do something to help them. *Mr. Patterson* (Staffs) also expressed disappointment that nothing had been done. Imports should be stopped when so many excellent tons of foodstuffs remained uneaten in the country. He asked what the Government would do if coal were dumped into this country, subsidized or bounty fed. How long would that be permitted? The Government was fiddling while agriculture was being ruined. He did not know whether the Government had any policy. He hoped one would be forthcoming soon, though he was afraid it would be too late to help the unfortunate potato grower.

The Minister said he did not think the potato question raised that of agricultural policy in general, but he would point out, as criticism had been made of undue delay on the part of the Government, that it was not the case that proposals, within the necessary limits which all Governments must set themselves, are simple matters. No Government had been able to fix upon plans of the complicated nature which would be required without very considerable study, and that even in the case of the late Government, a very long time had elapsed before their agricultural policy had been announced in a White Paper. The potato position was serious, and four years ago the Ministry had issued its Orange Book on "Potato Marketing." In that, plans were laid down which could have been adopted, and would have had a good effect even without further legislation. Nothing, however, had been done to utilize those studies and suggestions, but improvements in organization were now being considered, and Scottish farmers were tackling the problem. England would, no doubt, follow

suit. The driving force in these questions should come from the industry itself, though the Ministry was doing its utmost to assist.

The Report was then received and adopted.

Disinfection of Poultry Crates and Pens.—*Lt.-Col. Sir Merrik Burrell, Bart., C.B.E.* (West Sussex), moved the adoption of the Standing Committee's Report on the Disinfection of Poultry Crates and Pens (see Appendix V, page 393). He called attention to the fact that the Resolution by *Mr. A. E. Bryant* (Bucks) on the agenda was directly contrary to a part of the Report. He thought it might be possible to combine discussion and save time. The question of dealing with poultry disease was, in any case, very difficult, and the step proposed in the Report was one which was practicable. *Mr. A. E. Bryant* spoke upon the subject to the general effect that he was prepared to abide by the result of the discussion on this Report. *Dr. Addison* replied that the Ministry proposed to draft legislation on the lines indicated in the Report.

The Report was then received and adopted.

Standing Committee of the Council.—The Standing Committee was elected as follows: *Landowners:* Sir Francis Acland, Sir Merrik Burrell, Lord Clinton, Major Fawkes, Sir Arthur Hazlerigg, and Sir Douglas Newton. *Tenants:* Mr. J. Hamilton, Mr. R. G. Patterson, Mr. G. G. Rea, Mr. Cecil Robinson, and Mr. C. C. Smith. *Workers:* Professor Ashby, Mr. G. Dallas, M.P., Sir George Edwards, Mr. G. Hewitt, and Lady Mabel Smith, with Mr. Denton Woodhead, Chairman of the Council, an *ex officio* member.

Amendment of the Agricultural Holdings Act, 1923.—*Mr. W. Hearle* (Cornwall) moved:—

> "That the Council recommends that the Agricultural Holdings Act, 1923, be amended so as to have the following effect in respect to demands by tenants for arbitration as to rent:—
> (*a*) that arbitration should be compulsory and not optional;
> (*b*) that no tenant could demand arbitration unless he had been in occupation for at least four years; and
> (*c*) that in order to avoid unnecessary demands for hearings, in all cases where they fail all costs shall be paid by the appellant."

He said that it was fairly generally agreed that a good deal of land was unfairly assessed. After the War, landowners were not allowed to raise rents. When the time had come that they could, most of them did raise rents on a percentage basis; sometimes at 33⅓ per cent. Then the slump came, and

the best landlords reduced the rents, but others did not. Under the 1923 Act, if a tenant asked for a revaluation and it was refused, he had to leave his farm; the compensation granted was usually quite insufficient. The tenant knew his farm and its capacities; and in middle life, or in advanced years, it was difficult for him to make a new venture. Arbitration should be compulsory. *Sir Merrik Burrell* seconded the Resolution. *Mr. Goddard* thought that the Resolution was based on a misunderstanding of the Act of 1923. If carried, it would prove a disadvantage not only to the landowner, but still more to the occupier. *Brig.-Gen. Clifton Brown, M.P.*, said that the Central Landowners' Association's advice to its members was to be careful to pass on the advantages of derating to the tenant. He did not think the suggestion in the Resolution would do much harm one way or another.

Sir Charles Howell Thomas, K.C.B., C.M.G., Permanent Secretary to the Ministry of Agriculture, said that in one of the schedules of the Local Government Act of last year there was a direction to the Arbitrator, in determining the rent under the Act of 1923, to ignore the effects of the derating Act of 1929. That did not, of course, go to the root of the question, but it was a definite direction to an Arbitrator. He assured the Council that any Resolution on this matter which the Council adopted would receive the Ministry's earnest consideration. *Mr. W. Holmes* supported the Motion. *Major Fawkes* suggested that the resolution be not passed, but referred to the Standing Committee for a Report. The course proposed was duly seconded and agreed.

"Jöhnes Disease."—*Mr. J. S. Gibbons* (Glos) moved:—

> "That the Council asks the Ministry of Agriculture to impress on the Royal Veterinary College and any other veterinary institution concerned in Research the importance of discovering more than is at present known of the diagnosis of the disease called 'Jöhnes Disease,' which is a seriously increasing complaint in cattle."

Mr. Gibbons said that, as the Council well knew, the disease was a very insidious one, with which at present the veterinary profession was quite unable to deal. It was difficult to detect it in an animal, and veterinary opinion was that it was infectious. The nature of the disease rather assisted animals being patched up for market. He thought that further research was of the utmost importance, and that the Ministry should take active steps with regard to it. *Mr. H. W. Thomas* seconded the Resolution and suggested that the disease should

become compulsorily notifiable. *Sir Merrik Burrell* said that the Royal Veterinary College was already very keen about it and anxious to assist. Its Pathological Research Department had been working on the subject for over a year, and one veterinarian had visited important Continental centres.

Dr. Addison, for the Ministry of Agriculture, said the Chancellor of the Exchequer, notwithstanding pressure from other directions, had been willing to find money for further agricultural education and research. A central body has been established to survey and direct the many agricultural researches; their Report was now being considered. The Empire Marketing Board had also given money in addition to that from the Ministry, all of which might be directed to animal disease research. He hoped that, in these promising circumstances, progress would be made with regard to this disease before very long. *Mr. Gibbons* expressed gratification at this information. He did not think that the disease could be made notifiable until its nature was ascertained and it could be diagnosed. The Resolution was put to the meeting and carried unanimously.

The proceedings of the Council then terminated.

APPENDIX I

REPORT FROM THE STANDING COMMITTEE ON THE GRADING OF MILK FOR SALE

(1) At the meeting of the Council on October 31 last, a resolution was passed requesting the Minister of Agriculture to use his influence with the Minister of Health to secure a revision of the terminology, the scale of fees and the regulations respecting graded milk. At the meeting of the Council on February 6, 1930, the Chairman of the Standing Committee reported that, in addition to this request having been made to the Minister of Agriculture, the Committee were themselves looking into the question of milk grades, and would make recommendations to the Council in due course. This Report is the result of their consideration of the subject.

(2) The milk grades under the Ministry of Health's Milk (Special Designations) Order, 1923, are "Certified," "Grade A. (Tuberculin Tested)," "Grade A.," "Grade A. (Pasteurized)," and "Pasteurized." The definitions of these grades may be summarized as follow:—

"Certified"—herds tuberculin tested and submitted to veterinary inspection at regular intervals. Milk bottled on farm immediately after milking, with name of farm, day of production, and the word "Certified" on each bottle cap. The maximum number of bacilli per cubic centimetre allowed is 30,000, and no coliform bacillus in one-tenth cubic centimetre. The milk is not permitted to be treated by heat.

"Grade A. (T.T.)"—herds tuberculin tested and submitted to veterinary inspection at regular intervals. Milk not required to be bottled on farm, but delivered to consumers:—

(a) in the bottles or sealed containers received from the farm;
(b) in suitable containers of not less than two gallons capacity;
(c) in bottles with the name of the dealer by whom the milk was bottled, the address of the licensed bottling establishment, the day of production, and the words "Grade A. (T.T.)" on each bottle cap.

The maximum number of bacilli per cubic centimetre allowed is 200,000, and no coliform bacillus to show in one-hundredth cubic centimetre. The milk is not permitted to be treated by heat.

"Grade A."—has the same general conditions as "Grade A. (T.T.)," except that herds are not tuberculin tested. The milk is not permitted to be treated by heat.

"Grade A. (Pasteurized)"—conditions the same as in "Grade A.," except that after pasteurization, in the manner required by the Ministry of Health, it must not contain more than 30,000 bacilli per cubic centimetre, and no coliform bacillus in one-tenth c.c.

"Pasteurized"—any milk that after pasteurization, as required by the Ministry of Health, contains not more than 100,000 bacilli per cubic centimetre. This is the only grade of milk in which there is no requirement regarding containers, except that they bear suitable labels.

(3) The numbers of persons in England and Wales holding producers' licences under these grades on September 30 last were as follow:—

"Certified"	154
"Grade A. (T.T.)," Bottling 56, Non-bottling 165	221
"Grade A."	517
"Grade A. (Pasteurized)" / "Pasteurized"	Nil

(4) It will be seen that the number of producers who have taken advantage of the facilities given by the Order constitutes only a very small proportion of the total of milk producers, and it may therefore be inferred that the regulations have not of themselves been very effective in producing a cleaner and better milk supply. Apart from this general criticism, it has been widely objected that the grade definitions are not self-explanatory, that only a limited number of people even of those engaged in the milk industry understand them, and, further, that they do not place milk in any clear order of excellence so that the public may know at once what they are buying.

(5) On the other hand, it is an undoubted fact that the Order has been of considerable value in acting as a guide to milk producers in showing the way to improvement. The Order sets certain standards for milk which milk producers could aim at, even though they did not decide to produce milk under the regulations, being content with the ordinary means of sale in bulk and distribution. Other strong influences in the direction of improving the general quality of milk have also been at work, and we can now assert that the milk supply of the country is of a more uniform good quality, and very much cleaner and purer than it was 10 or 20 years ago.

(6) There is no doubt as to the nutritive value of good milk. Sir George Newman, Chief Medical Officer of the Ministry of Health, said about it at the World's Dairy Congress in 1928 that "It is one of the most valuable foods we know of, for it contains the essential and ideal constituents. A common mistake is to take insufficient milk, and there can be no doubt that if the English children could consume more milk they would have better health, and become physically stronger and mentally more capable. Happily, there are signs that the parents are at last waking to this fact."

(7) Milk is, however, of varying qualities, and milk from different cows and herds may vary very much in the contents of butter fat

and other solids quite apart from the question of cleanliness, and it is not fair to the producer whose costs are higher in producing high quality milk for the distributor and the public to be paying no more for better milk when sold through the ordinary channels than they pay for the poorer kinds.

(8) Bearing this powerful consideration in mind, the Committee have decided in recommending new grade names to the Ministry of Health, to recommend also to the Ministry of Agriculture that immediate steps be taken to improve the marketing of milk in the interests of the producer.

(9) It is a standing criticism of this country amongst other large milk producing nations that the consumption of milk is less than one half-pint per day on the average. Many other countries are reputed to drink much more: *e.g.*, Switzerland nearly two pints, Sweden, Denmark and Norway, all well over one pint, and the United States about one pint. We do not doubt that the figure for this country would be much higher if the British public had that confidence in the milk supply which we think its present condition justifies, and we consider that this confidence could be gained by giving the public a guarantee of quality by much more milk being produced under improved grade definitions.

(10) We would suggest that the grade names for milk should be altered as follow:—

(*a*) "Certified," with precisely the same conditions as at present, to be called **"Extra Special"**;

(*b*) "Grade A. (T.T.)" to become "Special" in all cases where it can be bottled either on the farm or very soon after. Stricter conditions would require to be worked out for this grade to prevent the milk remaining unbottled for any appreciable period in the hot summer, when the bacterial count may soon enormously increase;

(*c*) "Grade A." milk, with the same conditions as at present, except that the maximum bacterial count may be extended at first so as to bring in more producers, would become **"Standard"**;

(*d*) "Grade A. (Pasteurized)" to be called **"Standard Pasteurized."**

Milk not falling in any of these categories would be ungraded and sold as such.

(11) All graded milk would be sold to the public in bottles with labels according to the grade, and marked **"Extra Special"** (with name of farm, day of production, etc.), **"Special,"** **"Standard,"** or **"Standard Pasteurized."**

(12) In order to assist the increased sale of milk in towns, we would suggest that a short Act of Parliament be passed giving authorities of all urban districts of over 50,000 inhabitants power to require, if they so decide, that all milk brought into their areas of grades other than (*a*) and (*b*) be pasteurized in accordance with the Ministry of Health Regulations, *i.e.*, held at a temperature of 145-150° F. for 30 minutes and cooled to at least 55° F.; we are advised that no other method of pasteurization is effective for the purpose.

(13) The fees charged by the Ministry of Health for the issue of licences should, we think, be abolished. The service of assisting and improving the milk supply of the country is so important that progress should not be hampered by the need of making this State service self-supporting.

(14) We think that if this scheme as suggested were adopted, it could be used as the basis of a National Mark scheme, if thought desirable by the Ministry of Agriculture, under the Agricultural Produce (Grading and Marking) Act, 1928.

May, 1930.

APPENDIX II

REPORT FROM THE STANDING COMMITTEE ON THE MARKETING OF DRESSED POULTRY

(1) The Standing Committee has not previously dealt with this subject at all in its Marketing Reports. It now does so for the purpose of commending to the Council one of the most recent of the Ministry's National Mark Schemes, which comes into force on June 2, 1930.

(2) The Standing Committee discussed the question with officials of the Ministry, and formed the opinion, on the information supplied, that improvement in the marketing of home-produced table poultry must be seriously taken in hand if the home product is to gain supremacy in the fight with imported consignments. The main reason is that home-killed birds are not, in general, put upon the market in standardized packs and regular grades of properly conditioned carcasses. In recent years, poultry farmers appear to have given more attention to egg production than to the rearing of birds for the table. The two industries are not, however, by any means, water-tight compartments, and there is no reason why they should not be undertaken together on most poultry farms. Increased egg-production necessarily means production of more cockerels, which cannot possibly be marketed economically without organized effort. Many cockerel chicks are to-day killed at once or marketed for a few pence when they might be turned into good table poultry under an organized scheme, and made to show a substantial profit.

(3) The National Mark has been successful in stimulating egg production, and there seems no reason why it should not be similarly successful in regard to table poultry. Those who require more information as to the means and methods at present existing in the production of table poultry, as well as the directions in which they require alteration to achieve efficient production and marketing, should consult the Ministry's Report on the Marketing of Poultry (No. 11 of the Economic Series), which was issued in 1926. The National Mark Poultry Scheme is fully described in the Ministry's Marketing Leaflet No. 17.

(4) The National Mark Scheme, briefly, lays down statutory grade designations in respect of chickens, fowls, ducks, geese and turkeys, and standards of quality—A.1 and A.—for the majority of grades. A.1 birds are defined as well-fattened and of perfect quality, while A. birds are, in general, well conditioned without attaining the superior quality of the A.1 grade. Conditions are also laid down prescribing standard methods of packing and types of package, and there are also certain general requirements as to premises, equipment and the keeping of records.

(5) Poultry-keepers who desire to come in under the scheme should make application for enrolment through the County Branches of the National Farmers' Union. Their applications will then be submitted to the National Mark (Egg and Poultry) Trade Committee, consisting of representatives of producers and distributors, and presided over by an independent Chairman. This Committee will advise the National Mark Committee, which is the body empowered to authorize individuals or firms to apply statutory grade designation marks, *i.e.*, the National Mark, to particular agricultural products. The National Mark Committee may also revoke or suspend any such authorization in the event of failure to comply with the prescribed conditions. Infringements and all complaints regarding supplies packed under the Mark will be considered, in the first instance, by the Trade Committee.

(6) The minimum output of poultry-keepers eligible to be authorized as packers under the scheme is placed at 60 dozen birds per month in April and May, of which 15 dozen must be packed under the Mark; 80 dozen birds from June to December, of which 20 dozen must be packed under the Mark; in the months of January to March, no output qualification is required. In the calculation of output under these heads, poussins in the "Chicken" class, and turkeys and geese are excluded. It is competent for groups of poultry-keepers to combine for the purpose of forming a packing station under a packer's licence.

(7) It appears to the Committee that the scheme proposed is a sound one, and they recommend it to the Council and to poultry-keepers all over the country for adoption wherever practicable. There is no reason why poultry in the different stages of growth required by the market should not be supplied in regular quantities from home farms as easily as they are supplied from the Continent. A good market for first-class table poultry will always exist in this country, and it can, without doubt, be encouraged and developed by means of increased supplies of home-grown poultry at cheaper prices. The aim should be for growers to put upon the market home-produced poultry meat which will bear comparison cost for cost with the best butcher's meat, and quality for quality with the best imported dressed poultry. Poultry meat should, in fact, come into the ordinary family's weekly menu as an additional joint. It cannot do so while prices for the attractive qualities are beyond the average person's usual means for the supply of regular joints.

May, 1930.

APPENDIX III

REPORT FROM THE STANDING COMMITTEE ON THE LAW RELATING TO THE SALE OF MILK

(1) In connection with our inquiries into the general question of the production, grading, and consumption of milk, we have had under consideration the provisions of the Food and Drugs (Adulteration) Act, 1928, relating to the sale of milk, and the administration of these provisions, and desire to report the following facts to the Council, and to make the suggestions which will be found in the later sections of the Report.

(2) There is no doubt that the law in question, however well administered, necessarily involves a considerable amount of hardship to producers and sellers of milk, and there is reason to suppose that there are, and probably always will be, some districts and some authorities who will not administer this law in the most reasonable manner possible.

(3) The two main objections from the point of view of the producer and seller are these: (1) that the offence of selling adulterated milk is quasi-criminal, that is to say, the seller of adulterated milk must be convicted even though it is proved that he did not adulterate the milk and could not possibly have known of or prevented its adulteration; most local authorities, it is true, endeavour to avoid prosecuting innocent sellers of milk which has been adulterated without their knowledge or consent, but there are, and always will be, a certain number who refuse to take the responsibility of discriminating between cases where the sale was wilful and fraudulent and those where it was innocent: and (2) that the fact of adulteration is presumed against the person charged. A presumption of adulteration in the case of butter containing more than 16 per cent. of water is raised by the Sale of Butter Regulations, 1902, but with this unimportant exception the presumption of adulteration under the Sale of Milk Regulations

affords the only example of a fact on which a prosecution is based being presumed against the person charged.

(4) The general practice of local authorities is not to rely on the presumption named in (2) above, but to take into consideration all the circumstances affecting the question whether the milk is likely to be adulterated or not, and in nearly all cases "appeal to the cow" samples are taken. There are, however, numerous difficulties in the way of obtaining information as to these circumstances which might have affected the quality of the milk—the farmer himself may not know of them, and the practice of appealing to the cows does not give anything like complete security against the mischance of prosecuting an innocent person. It is now well known that the day to day variations which occur even in the mixed milk of a large herd (and must, therefore, be more frequent and pronounced in the case of small herds or single cows) make it very doubtful whether the fact that the appeal sample is richer in fat, or solids not fat, than the original sample can be regarded as reliable evidence that the original sample was adulterated.

(5) Many local authorities make the best investigation that circumstances permit, but the officials who make it their object to avoid prosecuting sellers in respect of milk which is not in fact adulterated often feel grave doubts as to how far they have succeeded, and there are some local authorities who decline to make the attempt and prosecute on the strength of the presumption in every case.

(6) There are also several objections to the present law from the point of view of the general public interest.

(7) The first is that the law does nor adequately provide for the detection and punishment of the wilful and fraudulent adulterator. The charge is that he "did sell adulterated milk." There is not, and cannot be anything in the summons to suggest that the seller wilfully or knowingly sold adulterated milk. The Court cannot, therefore, allow evidence to be given, even if it is available, to show that the offence was intentional. If this were done, it would amount to bringing a man before the Court on what is in the nature of a technical charge and then trying him for what amounts to a charge of theft. The evidence of intention is, therefore, excluded, and the magistrates cannot properly differentiate between the man who has robbed his customers by adulterating his milk and the man who has sold milk which is genuine but happens on some particular occasion to fall below the limits specified in the Sale of Milk Regulations. The dishonest adulterator is, therefore, in the same boat with the honest producer whose cows happen to have given milk of low quality. He can only be punished by a fine which is appropriate to a technical offence. The consequence is that the adulterator continues to adulterate.

(8) A further objection is that the tendency of the present law is to make bad citizens. A person who is summoned for selling adulterated milk may go into Court expecting a fair trial, that is, that the prosecution will prove that the milk was adulterated and that he himself was responsible. When he finds that the fact of adulteration is presumed and it is also presumed that he knew or could have known of the adulteration, he, whether guilty or not, and his friends, feel that he is the victim of legal trickery.

(9) Another objection from the point of view of the public is that the present law tends to keep down the supply of milk of the best quality. There are many cases where men who are admirably suited in every way to produce the best possible milk refuse to go into the business because they will not face the risk of the indignity of having to appear before their neighbours charged with an offence which is universally understood to suggest dishonesty.

(10) For these several reasons, we consider that it is highly desirable that the Council should recommend that the law be speedily amended. The amendments proposed might be the following :—

(11) *Milk should be taken out of the Sale of Food and Drugs Act and dealt with in a separate measure.* The reason for this is that milk is different both from the legislative and administrative point of view from other articles of food. It is more easy to adulterate and may be adulterated by any one of a large number of persons through whose hands it passes, whereas most articles of food when once they have been manufactured cannot, or can only with great difficulty, be adulterated. The other important distinction is that whereas the analyst can, as a rule, certify definitely to adulteration in the case of most articles of food, he cannot do the same in the case of milk. The result of the analysis of a single sample of milk is practically never proof of adulteration. The only way in which adulteration can be proved is by the evidence of an eye-witness or by circumstantial evidence based on analysis.

(12) **Criminal Liability.**—There are only two possible ways of securing a conviction based on the adulteration of milk. One is to presume the fact of adulteration on certain analytical results. The other is to prove adulteration by the evidence of eye-witnesses (occasionally available) or by circumstantial evidence (frequently available) based on analytical results. The first method is unjust and has been found to be unsatisfactory. If the second method is adopted, it follows that the duty of dealing with adulteration must be imposed on the local authority of the district where the adulteration takes place, as circumstantial evidence of adulteration is only obtainable on the spot. It also follows that as the sale of adulterated milk often takes place in a district remote from the place where the milk is adulterated, the offence must be not the sale of adulterated milk but the act of adulteration or the possession of adulterated milk. From the point of view of the authorities, the latter is preferable. The former is already an offence which might be retained.

The following proposals are based on the above consideration :—

It should be an offence for any seller of milk to adulterate milk or to be in possession of adulterated milk unless he proves :—

(a) that the milk was not intended for sale as milk ; or

(b) that he did not know and could not with reasonable care have ascertained that the milk was adulterated and that he gave the prosecutor all information in his power as to the persons from whom he obtained the milk.

A prosecution will have to be instituted by the local authority of the district in which the offence of adulterating milk or being in the possession of adulterated milk has been committed.

The defence that the adulterated milk was not intended for sale as milk is desirable in order to exclude the case of a farmer sending milk to a cheese factory which would be outside the scope of the Act, and also some conceivable cases of little practical importance.

The defence " that he did not know and could not with reasonable care have ascertained " is important. One of the complaints of the milk sellers is that under the present law they may be prosecuted and convicted for the sale of adulterated milk even though they are entirely free from moral responsibility. The same hardship will arise under the proposed law, but the defence will meet it to a great extent. It also does away with the necessity for the warranty defence which is objectionable on several grounds. The second part of this defence—" and that he gave the prosecutor all information in his power as to the persons from whom he obtained the milk " will be a convenience to local authorities in ascertaining who are the sellers who are likely to be in possession of adulterated milk.

(13) *Adulterated milk should be defined as milk from which anything has been abstracted or to which anything has been added since it left the cow, except skimmed milk, which should be defined as milk containing less than 0·1 per cent. of milk fat.* The object of this definition is to allow a dealer in skimmed milk or separated milk to be in possession of milk from which something has been abstracted without committing an offence. " Fore " (*i.e.*, first drawn) milk would not be adulterated milk. The sale of fore milk would be covered by the provisions as to civil liability.

(14) *It should be an offence for any seller of milk to deliver milk to a public carrier except in churns which have been effectively closed and sealed.* This will not affect the criminal liability of the seller as he cannot be prosecuted for being in possession of adulterated milk on a sample taken after he has handed the milk to a public carrier, but it is only fair to the purchaser that the producer should seal his churns. The purchaser might be prosecuted because he was in possession of milk which was adulterated in transit. This provision will also be regarded as a concession by the large number of persons interested in public health who believe that milk is frequently or commonly contaminated by porters and others dipping dirty cans into it.

(15) *The officers appointed to execute this Act should have power to enter any premises registered under the Milk and Dairies Order and to take samples therein and power to take samples of milk for the purposes of the Act in any place or premises while in the possession of any seller of milk.* The power of entry would make adulteration by farmers and dairymen very difficult as the times at which the adulteration must take place are generally known, and by entering the premises at these times the Officers of the local authority could compel the farmer or dairyman either to adulterate in his presence or disappoint a certain number of his customers.

(16) *The local authority of any district which has reason to believe that adulterated milk has been sent into its district from premises outside its district may report the circumstances to the local authority of the district in which the milk originated, and thereupon it shall become the duty of the local authority of that district to ascertain, by taking samples and otherwise, whether adulterated milk is in the possession of any seller of milk in its district, and to institute proceedings against such person if sufficient evidence of an offence is obtained.*

(17) **Civil Liability in respect of quality.**—The law as to adulteration should be supplemented by requiring warranties involving civil liability as to the quality of milk. There are certain advantages in imposing a measure of civil liability on sellers of milk. The local authorities are at present and will always be in a difficult position if they have no means of controlling the quality of milk except by alleging adulteration. In many cases they must decide whether milk is adulterated or not with nothing before them but an analysis, and they must either do nothing or prefer what amounts to a charge of fraud against the seller. If they could fall back on the implied warranty in doubtful cases, it would improve their position and also that of the seller, who would be less exposed to reckless prosecutions. At present, so far as the law is concerned, the seller of milk has no reason for selling milk of good quality except that if he sells milk of poor quality he runs a certain risk of being unjustly charged with selling adulterated milk. The warranty expressed or implied would

stimulate the competition among milk sellers in respect of the quality of their milk, and encourage the public to drink more milk.

The warranty system would also give milk producers who produce good quality milk an advantage in competition with those who keep breeds of cows which give milk containing a low percentage of fat or solids not fat, or select cows for quantity only. If the seller of milk is required in effect to give a warranty as to the quality of his milk, adulteration will become more unprofitable than it is now. If the Sale of Milk Regulations are repealed, or if they become a dead letter, there will certainly be a strong demand for a standard or standards of some kind, and the least objectionable way of meeting the demand is to require sellers to set up standards for themselves by means of warranties. The proposals made in the following paragraphs are, then, based on the above considerations :—

(18) *On the sale of milk there shall be an implied warranty that the milk contains 3 per cent. of fat and 8·5 per cent. of solids not fat.* This, of itself, involves little alteration in the present position. The purchaser of milk to sell again probably has this warranty now (see Section 14. (2), Sale of Goods Act, 1893). The implied warranty could, however, be varied by an express warranty. If any seller felt justified in warranting that his milk contained 4 per cent. of fat and 9 per cent of solids not fat, he could give, by notice, an express warranty that his milk was of that quality. If, on the other hand, he thought that his milk would not come up to the implied warranty, he could give an express warranty that it contained, say, 2 per cent. of fat and 7·5 per cent. of solids not fat. In the latter case, he might have to take a lower price for his milk, but this seems reasonable.

From the commercial point of view, the warranty should relate to the percentage of fat only. What the purchaser wants is value for money, and fat is the costly constituent in milk. But, from the point of view of nutrition, the solids not fat are of great value, and as the civil liability in respect of quality is intended to supplement the criminal provisions as to adulteration there must be a warranty as to solids not fat also.

(19) *The local authorities, who might be the same as those who now enforce the Food and Drugs (Adulteration) Act, should have power to take samples for the purpose of testing the warranty.*

(20) *The local authority of the district in which any milk is sold should have power to claim five shillings damages, recoverable in a County Court in the event of non-payment, in respect of the sale in their district of any milk which did not come up to the implied warranty or the express warranty as the case might be, provided a sample had been taken in the prescribed manner.* Purchasers of small quantities of milk would never claim on the warranty, and therefore to make the civil liability of milk sellers operative the local authority must make claims on behalf of the community. The amount suggested as damages is based on the estimated loss to the purchasers of nine gallons of milk deficient to the extent of 1 per cent. below the warranty. Nine gallons of milk is about the average quantity consigned, or exposed for sale, and the price of 50 per cent. cream is taken to be 3s. per lb. It is essential that the damages should be small, and should be recoverable in a County Court and not in a Criminal Court, so that the civil liability of the seller for breach of warranty may be kept quite distinct from the criminal liability of a person who has adulterated, or has knowingly been in possession of adulterated milk.

(21) *The seller from whom a sample has been taken should have power to require the local authority to submit the third part of the sample to the Government Chemist. The fee payable to the Government Chemist should be fixed by the Treasury and paid by the local authority, and should be recoverable from the seller if the Government Chemist's Certificate supports that of a Public Analyst.*

(22) *Local authorities should be given power to make joint appointments of officers to execute this Act.* This principle is embodied in the Fertilisers and Feeding Stuffs Act. Many authorities under that Act have made joint appointments, each instructing their own officer not to act in the district of the other except in a matter arising in his own district. This provision would meet the views of local authorities of municipalities which may feel that they ought to have power to prosecute farmers who send adulterated milk into their districts.

(23) *The Ministry of Agriculture or the Ministry of Health should have power to act in default of any local authority.* It is not likely that it would ever be necessary to exercise this power, but it would satisfy many local authorities who may feel that they will be dependent for the protection of their constituents against fraud on other local authorities whom they do not altogether trust.

May, 1930.

APPENDIX IV

REPORT FROM THE STANDING COMMITTEE ON THE POTATO POSITION, IN CONNECTION WITH RESOLUTION PASSED AT THE COUNCIL'S MEETING OF FEBRUARY 6, 1930

(1) The resolution passed at the meeting of the Council on February 6, 1930, was in the following terms :—

> "That the Council of Agriculture for England calls the attention of the Government to the serious condition of the Potato-growing industry in England, and urges immediate inquiry into the matter with a view to ascertaining the best ways and means of assisting the industry."

The resolution was passed by the Council on the understanding that the Standing Committee would go into the matter immediately and take what steps were practicable for it to assist in the effort to dispose of the crop surplus. The Standing Committee accordingly, at its meeting on February 20, discussed the question with Mr. J. T. Briggs (Soke of Peterborough), Mr. Cecil Robinson (Holland) and Mr. R. L. Walker (Yorks, West Riding), all members of the Council, and decided on certain general lines of action and inquiry, and sent a resolution on the subject to the Minister with the suggestion that the matter be considered by the Agricultural Conference then sitting. The Standing Committee was informed that the subject was duly placed before the Conference with a report to the effect that a Committee composed of representatives of all branches of the potato industry, including merchants and wholesalers, had the problem under consideration, and the Minister did not, therefore, propose to call another Conference on the lines suggested in the resolution.

(2) The Standing Committee then interviewed other persons connected with the industry, and discussed with the Market Representative of British Columbia in this country the British Columbia Produce Marketing Act, 1927, as consolidated last year, which enables a Committee of Direction in that Province to be set up to control and regulate the marketing of any product within the State's boundaries. Under it, the quantity of any product marketed, and the place and time of marketing, as well as the price, are controlled, the application of the Act to any commodity being dependent upon 75 per cent. of the producers petitioning the Government. It appears that the chief benefit of the Act to the producer is that regular prices are now enjoyed in place of the very fluctuating ones which existed before.

(3) The Committee envisaged two lines of action that seem called for in respect of Potato marketing: (1) immediate steps to assist the disposal of the remainder of the crop, including, possibly, prohibition of imports; and (2) legislative steps, on the lines of the British Columbia Act, coupled with appropriate co-operative action, to ensure that the difficulty of large surplus production without adequate means for its disposal should not occur again.

(4) Under the first head, an immediate propaganda campaign was suggested, and the Ministry took certain immediate action, which included the broadcasting of the facts concerning the high quality of last year's potato crop, and the preference that should be given it rather than to the new potatoes imported from abroad, as well as suggestions for other means of disposal, including silaging at a later date when hay became available. These facts and suggestions were also given currency in the public Press, and no doubt served to assist the demand from the public, and from various local institutions, such as hospitals, unions, asylums, etc. It was understood that the National Farmers' Union and other bodies were proceeding along similar lines, so that a considerable effort was being directed to a common purpose.

(5) The question of the feeding of as many lower-grade tubers to live stock as possible was considered to be so obvious as not to need any emphasis from the Committee. The new method of preserving such potatoes for use later in the year by silaging them with layers of new cut grass was specially considered. This method had been successfully used in Holland and was being submitted to special tests in regard to potatoes of the 1928 crop at the Kirton Farm Institute in Lincolnshire. It had been referred to in the JOURNAL OF THE MINISTRY for January, and was so evidently good that the Committee asked the Ministry to consider the further public recommendation of it for use when grass became sufficiently plentiful. This suggestion was also acted upon, and notices drawing attention to the matter have appeared in the Press and have been broadcast, together with accounts of other methods of silaging without hay, principally for pig fodder.

(6) Other steps which have been suggested are the following:—

(*a*) the drying of potatoes either in slices, by means of exposure to hot air, or in flakes by cooking and drying on hot rollers;

(*b*) the manufacture of potato starch (*farina*) for use in the textile industry for sizing yarns, for finishing purposes and also for the manufacture of glucose and dextrine and various gums and products of a like nature.

(*c*) manufacture into alcohol to replace petrol and paraffin and power for lighting purposes, and

(*d*) for use in the manufacture of acetic acid employed in the artificial silk industry.

The Committee has not, however, gone into details of the merits of these various additional suggestions, and must not be understood to recommend them. It gathers that they are being examined by the Committee referred to in the first paragraph, which will, no doubt, recommend any or all of them if due cause is shown.

(7) We understand that the Government is proposing a new agricultural marketing Bill, which will have a somewhat similar effect to that of the British Columbia Produce Marketing Act to which reference is made in paragraph (2) above. This, if passed, will give the necessary powers to primary producers, where 75 per cent. of the growers' interests are in favour of appropriate action being taken to deal with the crop on national lines in the interest of producers.

May, 1930.

APPENDIX V

REPORT OF THE STANDING COMMITTEE ON THE DISINFECTION OF POULTRY CRATES AND PENS

(1) It has been brought to the notice of the Standing Committee that the regulations existing for the cleansing of poultry crates and pens do not appear to be as effective as they might be for arresting the spread of poultry disease. The present position is a simple one; the Poultry Act of 1911 gave the Minister of Agriculture the power to make orders:—

(*a*) for protecting live poultry from unnecessary suffering while being conveyed by land and water and in connexion with their exposure for sale and their disposal after sale;

(*b*) for requiring the cleansing or disinfection of receptacles or vehicles used for the conveyance of live poultry.

(2) Under these powers, the Minister made an Order called the Conveyance of Live Poultry Order, of 1919, which, *inter alia*, required owners of poultry which were being conveyed by land or water to any place in Great Britain to cleanse the receptacles thoroughly after each use, *i.e.*, before being again so used and, if sent by railway or vessel, before being again so sent. This provision was clearly made rather to prevent suffering than to prevent the spread of disease. The Poultry Act, 1911, says, "cleansing or disinfection" and refers to "unnecessary suffering." In that Act there was no suggestion that it was intended to deal with poultry disease.

(3) The Committee has had the benefit of discussing this question with Sir Ralph Jackson, M.R.C.V.S., the Ministry's Chief Veterinary Officer, and is convinced that it is not practicable to schedule poultry diseases and draw up schemes for preventing their spread—which would include the investigation of outbreaks, restriction on movement, the slaughter of diseased birds, &c., as in the case of animals—and, for this reason, it is the more desirable that other effective steps should be taken which will militate against the spread of poultry disease. All poultry owners will, of course, realize the danger to which they are subjecting the flocks of other poultrymen when they send about the country, or to market, birds which are diseased, or have been in contact with diseased birds. Instances where they would knowingly do so would, of course, be rare, and such poultry owners concerned would be guilty at the least of a considerable moral offence, but there would probably be numerous cases of birds being sent about the country and carrying disease where the owners are entirely unaware of the fact.

(4) The Committee suggests that the evil effect of such cases from the point of view of spread of disease would be lessened if local authorities are empowered to require that all poultry pens in the markets, as well as all receptacles used in the traffic, are cleansed by scraping, washing and thorough disinfection, such as takes place in the case of animals marketed under the provisions of the Markets, Sales and Lairs (Amendment) Order, 1926, and it suggests that the law be amended accordingly.

May, 1930.

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JULY ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,
Director of Agriculture for West Sussex.

PASTURES are now at a critical stage; the first flush of leafy growth has spent itself, and many grasses have developed ears and are ripening seed.

The nutritive value of stem is much inferior to leaf, and the riper the stem the higher the fibre content. The growth of leaf is now less rapid and the nutritive value of pastures has much declined.

Milk yields may now be expected to fall and decreased yields will be more pronounced during a dry spell. Early grazing of hay aftermaths will help to maintain the flow of milk; green forage crops such as late-sown tares have a beneficial influence; green lucerne is particularly well suited for feeding at this period. Any green succulent food can be recommended with confidence at this period of the year. The use of concentrated foods in the form of a balanced ration for all yields over the assessed value of the pasture is advantageous from the point of view of milk yield, but the yields are not influenced in such a pronounced and immediate manner as when a fresh leafy pasture or green succulent forage is available.

The writer has studied the daily milk yield of a herd in the south, where regular quantities of milk are maintained throughout the year and, consequently, there is a fairly regular supply of fresh calved cows brought into the herd throughout the year.

In assessing the fall in yield per week no account is taken of cows being dried off, or of cows yielding less than 10 lb. of milk per day, and newly-calved cows are not included until four weeks after calving, so that the rise which normally takes place during the first three or four weeks in the milking period is eliminated. The object of such observations is to note the influence of any conditions which tend to raise or lower the yields.

No two years give the same results, even though the conditions under control are the same. During the period when full winter rations are being used the weekly decrease in yield is fairly steady, and is what may be expected regard being had to the advance of the lactation period. Under summer conditions the yields are more erratic. Early spring grass raises the yield, and an increase may take place for two or more weeks and may be maintained for a further period, but after four weeks or so decreases again commence, steadily

at first but becoming more pronounced just after mid-summer. In dry seasons the decrease is earlier and more rapid. The heaviest decreases in yields coincide with the greater tendency of grasses to run to seed, and farmers date the decrease from the time of the flowering of the Elder Bush.

The present critical time may be illustrated by reference to the fall in the weekly yield in the herd under observation. On an average of seven years the first 17 weeks of the year show a steady and constant decrease week by week; in the eighteenth and nineteenth week, which is the first part of May, there are increases in yields each week, but thereafter decreases are continuous. At the end of the twenty-second week the yields are approximately the same as at the end of the seventeenth week.

On the scale used the average drop in yield up to the end of the seventeenth week was 16 points per week; owing to the rise in yield at that time, the average fall per week for the first 22 weeks was only 14 points; during the next four weeks, corresponding with June, the fall was 24 points per week; and in the succeeding four weeks 25 points per week, after which the fall again approximated to what took place during the first 17 weeks.

This herd is on a farm where specially early grass is available, and the flushes and decreases are a little earlier than the usual experience in the district, but apart from the dates, the experience is a general one.

Arable Crops.—Some idea may now be formed of the harvest prospects. Winter-sown barley, oats and wheat in the south will be ready for harvest towards the end of the month. The earliest of the grain crops is rye, but the amount grown for harvest as grain is small. A considerable acreage is still sown each autumn to provide early forage to be used green, principally for ewes and lambs in April. As a forage crop it is apt to run rapidly to stalk and become unpalatable, but it is early and there is a very real advantage in that it is a good preparation for root crops such as mangolds or swedes. The preparation of a tilth for root crops after rye fed off by sheep is easy and can be done with a minimum of cultivation. Barley is also used as a green forage crop, and comes in later than rye, but the greater proportion of the autumn-sown barley is harvested for grain. There are considerable advantages in sowing barley in autumn; it is sown early and harvested early and tends to a better distribution of labour.

The hardy six-rowed varieties are usually chosen and good yields of feeding quality can be obtained. In recent years there is an increasing tendency to sow some of the two-rowed barleys in the autumn, and, whilst a hard or very wet winter does considerable injury to the crop, some very good yields of fair quality barley are often obtainable.

Autumn-sown oats come between winter barley and wheat at harvest. A number of varieties are available for autumn sowing, but some are not reliable in a severe winter.

Grey Winter and Black Winter Oats are the hardiest varieties, and are suitable over a wide area. The grains are thin skinned and of good feeding quality, but the weakness of the straw is a disadvantage and may be troublesome at harvest. Strong strawed white oats, such as Marvellous and Plentiful, are less hardy; after a series of mild winters the cultivation of these varieties increased, but this increase was somewhat checked by two recent severe winters. In some districts white oats have a higher market value than either grey or black oats, and with a stronger straw this is an added advantage. Where oats are grown for home consumption a mixture of the white and grey or white and black produces heavy yields, and the stronger straw of the white varieties helps to prevent the severe lodging of the weak strawed varieties. A very real advantage in autumn-sown oat crops is that they are practically free from an attack of the frit fly, which is the principal enemy of late-sown spring oats.

The Grading and Marking of English wheat flour under the Agricultural Produce (Grading and Marking) Act, 1928, has had a favourable start, the quality of English wheat in 1929 having been high owing to the dry season for growth and harvest. The existence of a trade in English flour on its own merits makes it most important that well harvested dry samples should be available. A plump grain is necessary in order to get a high percentage of flour from the wheat. If cut too early, the grain shrivels up and a reduction in yield results. On the other hand, if cutting is delayed too long, serious loss may result from shedding of the grain owing to high winds or during cutting and harvesting operations. The wheat should be cut in a dry condition and be at once "stooked" or "shocked." Stooking is too often not so well done as it ought to be, with the result that sheaves get blown down or fall, and during heavy rain become soaked and spoiled to a much greater degree than if standing up properly. Showery and mild weather readily spoils a crop, and

some of the rough-chaffed wheats suffer badly under such conditions. When wheat straw is clean and free from green weeds or grass it does not require to stand long before being carted. The drier it is carted the sooner it will be fit to thrash and give a good milling sample. In practice, wheat is often carted whilst still slightly damp from dew or a recent shower, and, whilst such conditions may not injure the wheat, they start a certain amount of sweating, and time must be allowed for this to clear off before thrashing.

In the drier districts of England, some wheat is often thrashed direct from the field. This practice results in a considerable saving of labour and avoids much waste. It is seldom that the weather is settled enough to permit of the whole crop being so dealt with, and, in any case, wheat which is not really dry keeps and improves under stacked conditions, whereas if thrashed there is a risk of damage unless the wheat is conditioned or dried before storage. The moisture content of grain is an important feature in the milling; dry wheats are more easily ground and there is less loss by evaporation during the process of milling. The dryness also materially affects the keeping quality.

Freedom from smut and bunt is of the greatest importance, and many samples are quite unfit for milling on account of these preventable troubles.

The variety of wheat has an important bearing on quality. The greater proportion of the varieties available for growth in England are known as soft wheats, and produce a type of flour well suited for biscuit and pastry baking, but less suited for commercial bread making as generally practised at the present time.

In selecting a variety, growers of wheat should follow the results of local trials. Coarse soft wheats have a market as poultry grain, and it is not unusual for poultry wheat to be higher in price at certain seasons of the year than good milling wheat. In such circumstances, yield per acre becomes the most important factor. It is wise, however, to select a variety which could be available for either purpose, and attention to milling quality need not mean the selection of a variety likely to give a poor yield.

Among English varieties, the Yeoman wheats excel in strength or quality for bread-making, and a special grade of flour is provided for the produce of these wheats. Yeoman is eminently suited for growth on the richest wheat lands or in land of a high degree of fertility. It is equipped with a par-

ticularly good standing straw and the results at thrashing usually exceed expectations. Too often it is condemned because of its appearance during the winter or early spring; it responds well to manuring and is worthy of wider use than obtains at the present time.

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PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended June 11				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15¼%) .. *	10 2d	10 2d	10 2d	10 2d	13 0
Nitro-chalk (N. 15½%) .. *	9 19d	9 19d	9 19d	9 19d	12 10
Sulphate of ammonia :— Neutral (N. 20·6%) .. .. *	10 2d	10 2d	10 2d	10 2d	9 10
Calcium cyanamide (N. 20·6%) *	9 6e	9 6e	9 6e	9 6e	9 0
Kainit (Pot. 14%) .. .. §	3 6	2 19	2 19	3 3	4 6
Potash salts (Pot. 30%) .. §	5 3	4 18	5 0	4 19	3 4
" (Pot. 20%) .. §	3 15	3 9	3 8	3 11	3 7
Muriate of potash (Pot. 50%) §	9 17	9 3	9 2	9 5	3 8
Sulphate,, ,, (Pot. 48%) §	11 19	11 6	11 5	11 5	4 8
Basic Slag (P.A. 15¾%)‖ .. §	2 13c	2 3c	..	2 9c	3 1
" (P.A. 14%)‖ .. §	2 7c	1 16c	1 16c	2 3c	3 2
" (P.A. 11%)‖ .. §	..	1 9c	1 9c	..	..
Ground rock phosphate (P.A. 26-27½%)‖ .. .. .. §	2 2a	2 10a	2 5a	2 7a	1 9
Superphosphate (S.P.A.16%).. §	3 11	..	3 9	3 6	4 2
" (S.P.A.13½%).. §	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3¾%, P.A.20½%) §	8 15	8 10	8 12	7 7	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%) .. .. §	5 17b	5 15f	6 10	4 7	..

Abbreviations: N.=Nitrogen; P.A.=Phosphoric Acid; S.P.A.=Soluble Phosphoric Acid; Pot.=Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 80% through standard sieve. *a* Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

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NOTES ON FEEDING STUFFS

H. G. SANDERS, M.A., Ph.D.,
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Summer Grass (continued).—In last month's "Notes," the question of supplementary feeding to cows on grass was discussed. The biological principles on which the procedure should be based apply to other grazing stock similarly, but, in general, supplementary feeding is restricted to milking cows. This may be attributed chiefly to the fact that the effects of changes in the nutritive value of pasture are blatantly advertised by the yields of such animals, whilst, with store or fattening stock, changes in the rate of progress can only be detected after a considerable time, and then only by experienced men. Intelligent supplementary feeding would give similar returns with other classes of stock, but it does not necessarily follow that it is to be recommended. With a dairy herd, financial commitments are large and labour is a big item; in addition, there is another factor to be considered in the demands of the selling contract that have to be met. With other cattle and with sheep the last factor does not arise, while labour is much lower, and, consequently, it may be that the best results are obtained by slightly less intensive management. Thus, though it should be recognized that deficiencies arise in their case in the same way, it is probably the best policy to be content with a lower rate of growth, in order to avoid the expense of supplementary feeding.

The cost of concentrates is a serious item and, in the case of milking cows, must be carefully considered. Summer milk sells at a lower price than winter milk because the expense of grazing is less than that of winter feeding, and it is to be remembered that, though supplementary feeding may have a beneficial effect on milk yield, it may cost more than the value of the extra milk it produces, unless it is done at minimum expense. The additional food provided must be concentrated to be effective, but the purchase of large quantities of cakes and meals must be avoided when possible. As was pointed out last month, in certain cases, when supplementing a limited amount of young grass, cereals will be the best, and, at their present prices, few farmers will grudge feeding their own produce rather than selling it. In general, farmers will rightly prefer feeding home-grown foods to purchased ones.

The question, therefore, arises whether it would not be sound policy to grow catch crops especially for this purpose,

providing a succession from June onwards, when they will be needed. Here great care must be taken to assure that the supplement really is more nutritious than the grass, and this necessitates that it should always be used in an immature state. It follows that the growing of these supplementary catch crops requires considerable skill, and that very small areas must be sown at a time, as each piece will only remain near its optimum state for feeding for round about a fortnight. This means that the provision of the catch crops may lead to just that extra expense which it is hoped to avoid by cutting down the cake bill. That there is a very real danger of this is evidenced by the fact that very few catch crops are grown for this particular purpose, although large numbers of farmers realize their theoretical desirability.

There is one crop, however—lucerne—which would appear to be eminently suitable, but which has been taken up very slowly here, and plays only a small part in this country. Its advantages are many and great. If once well established, it lasts for a number of years and needs but little attention (though probably rather more than it usually gets), and it gives practically a continuous succession of cuts of young forage all through the summer. In particular, its long roots enable it to continue growing during droughts, when it is especially needed. As a standby, it meets the requirements admirably. In other countries, where grass is less reliable than with us, it plays a much bigger part, but its merits should give it a great opening even under our conditions. If the great weakness of grass is that it is very unproductive during droughts, a somewhat similar green succulent crop, with a high protein content, that is particularly drought resistant, would seem to cry aloud for inclusion in the cropping system.

It is apparent that supplementing pasture is a difficult business, needing great skill and judgment, both in deciding when and how to do it, and in carrying it out without incurring large additional expense. It is not surprising, therefore, that many progressive farmers are turning eagerly to the alternative of avoiding it by keeping pastures always in the short nutritious state—that is by rotational grazing. Although this is only possible with small fields, and the cost of fencing and supplying water is large, such serious drawbacks will not preclude the change over to this system, if it can be demonstrated that, under practical conditions, it is a feasible proposition. The initial expense and the outlay on artificial manures are undoubtedly heavy, but they will be easily out-

weighed by the possibility of producing throughout the summer—as opposed to a period of about a month—a concentrated and highly productive food. The really fundamental difficulty lies in the stocking, because no one has yet suggested any means by which grass can be persuaded to grow steadily at a constant rate, and independently of the weather, throughout the summer. It was indicated in last month's notes that this hard fact of nature has led to the adoption of a middle course, which carries with it the whole trouble of supplementary feeding.

There is another possibility, however, which may be developed, and that is to arrange the stocking at a lower level, allow the grass at favourable growing periods to get away, and keep it in check when this happens by mowing. To be effective, the mowing must be done long before it will pay to cut and cure for hay in the ordinary way; clearly it will be a heavy weight round the neck of the system if the cuttings are to be wasted. On the other hand, if they can be preserved for feeding during the winter, the excess of grass will immediately change over from being a drawback to becoming one of the chief merits of the whole system, for if there is one thing that would help British farmers it would be a method of producing a home-grown high-protein concentrate for winter feeding. Preservation might be done in the form of silage, but storing it in the dried condition is the more attractive proposition. The Cambridge investigators have thus been led to inquiry along the lines of grass cakes, and in their latest report they have described studies on the fundamental question in this direction, namely, whether the very valuable feeding properties of young grass are at all impaired by drying and storing.

This question needed clearing up at the outset, because the view is widely held that the digestibility of succulent material, and in particular of its protein, which, in this case, is the paramount consideration, is seriously depressed by drying with heat. Dr. Woodman, however, had already shown that this did not happen in the case of some foods, and in the latest report it is shown that young grass can be dried without spoiling its excellent qualities. Two methods of drying were tried. In the first, the young grass was dried in steam-heated troughs, being continually churned round during the process, and was then pressed into cakes; in one case briquettes were made so solid that it only took 26 cubic feet to weigh a ton. The moisture content was reduced to

about 12 per cent. In the other method, kiln drying was carried out, and this clearly offers the greatest scope for farmers on their own premises. A 4-inch layer of grass was put on the floor of the kiln, and the hot gases from an anthracite fire were allowed to percolate through it. On account of its initial moisture content, the temperature of the grass did not rise above 50° C. for some time, and later to 90° C. as it became drier. The grass was turned by hand every half-hour, and was kept on the floor for three hours, by which time its moisture content had been reduced to 2·4 per cent.; on cooling this rose to 9 per cent.

Grass dried by either method kept very well (no change took place in two years), and digestion trials with sheep showed that the starch equivalent and digestibility of all constituents of its dry matter were the same as in the green state. This was confirmed in feeding trials carried out with it on the Cambridge University Farm, where it was given, up to 7 lb. a day, to fattening steers, and also, mixed with one-third of its weight of oats to balance it up, to dairy cows for the whole of the production part of the ration. In both cases the results agreed with the laboratory trials, that the dried grass retained the high feeding properties it possessed when succulent. Grass cakes are convenient for storage and handling, though of course the grass need not necessarily be pressed into cakes; the material keeps its green colour, has a pleasant smell, and is readily eaten by cattle and sheep, either dry or soaked in water.

With this information, it will be only logical to proceed with inquiries as to the best methods of preserving grass on these lines in practice. It is now evident that there are great possibilities, but a number of practical difficulties remain. The grass used in the above experiments was cut from lawns and playing fields by lawn mowers, and cutting an ordinary pasture is a very different thing. On the other hand, the grass above mentioned was cut after only one week's growth, whereas it has now been shown that it can be permitted three weeks' growth without lowering its nutritive value. In fact, longer intervals are desirable as giving a greater total amount of produce in the season, and under the conditions in which it would be necessary on the farm (the grass getting away from the stock) longer grass would be cut than was used at Cambridge. This would be of additional benefit as avoiding the inclusion of so much soil from worm casts, etc., which was somewhat troublesome in these trials. There is no point

in minimizing the difficulties, since they are very apparent, but it should not be beyond the wit of man to overcome them. With the knowledge that, by drying, grass can be preserved indefinitely without harm to its feeding value, investigators will proceed to solve the problems that arise, well knowing that if a final economic solution can be found it will certainly help to give the British farmer once more a place in the sun.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £	s.
Barley (Imported)	71	6·2	5	2
Maize	81	6·8	7	0
Decorticated ground nut cake	73	41·0	8	0
" cotton cake	71	34·0	10	0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·54 shillings, and per unit protein equivalent, 2·10 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm	
	Per cent.	Per cent.	£	s.
Wheat	72	9·6	6	11
Oats	60	7·6	5	8
Barley	71	6·2	6	2
Potatoes	18	0·6	1	9
Swedes	7	0·7	0	12
Mangolds	7	0·4	0	12
Beans	66	20·0	7	4
Good meadow hay	37	4·6	3	7
Good oat straw	20	0·9	1	13
Good clover hay	38	7·0	3	13
Vetch and Oat silage	13	1·6	1	3
Barley Straw	23	0·7	1	17
Wheat straw	13	0·1	1	0
Bean straw	23	1·7	1	19

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d. net.

Description	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British..	—	—	8 13	0 12	8 1	72	2 3	1·20	9·6
Barley, British	—	—	7 0	0 9	6 11	71	1 10	0·98	6·2
„ Canadian feed	17 9	400	5 0*	0 9	4 11	71	1 3	0·68	6·2
„ Danubian	18 3	„	5 2*	0 9	4 13	71	1 4	0·71	6·2
„ Persian..	17 9	„	5 0	0 9	4 11	71	1 3	0·68	6·2
„ Russian..	18 9	„	5 5	0 9	4 16	71	1 4	0·71	6·2
„ Tunisian	18 3	„	5 2†	0 9	4 13	71	1 4	0·71	6·2
Oats, English, white	—	—	6 10	0 10	6 0	60	2 0	1·07	7·6
„ „ black and grey	—	—	7 0*	0 10	6 10	60	2 2	1·16	7·6
„ Argentine	14 0	320	4 18	0 10	4 8	60	1 6	0·80	7·6
„ Chilian	15 0	„	5 5	0 10	4 15	60	1 7	0·85	7·6
„ German	18 0	„	6 7	0 10	5 17	60	1 11	1·03	7·6
Maize, Argentine	29 0	480	6 15	0 10	6 5	81	1 7	0·85	6·8
„ South African	31 6	„	7 7§	0 10	6 16	81	1 8	0·89	6·8
Beans, English winter ..	—	—	8 10†	1 4	7 6	66	2 3	1·20	20
„ Chinese	—	—	9 12§	1 4	8 8	66	2 7	1·38	20
Peas, Japanese	—	—	15 15§	1 1	14 14	69	4 3	2·28	18
Dari	—	—	7 5	0 11	6 14	74	1 10	0·98	7·2
Milling offals—									
Bran, British..	—	—	4 2	1 1	3 1	42	1 5	0·76	10
„ broad	—	—	5 2	1 1	4 1	42	1 11	1·03	10
Middlings, fine, imported ..	—	—	5 15	0 17	4 18	69	1 5	0·76	12
„ coarse, British ..	—	—	4 7	0 17	3 10	58	1 2	0·62	11
Pollards, imported	—	—	4 5	1 1	3 4	60	1 1	0·58	11
Meal, barley	—	—	6 10	0 9	6 1	71	1 8	0·89	6·2
„ maize	—	—	8 0	0 10	7 10	81	1 10	0·98	6·8
„ „ South African ..	—	—	6 17	0 10	6 7	81	1 7	0·85	6·8
„ „ germ	—	—	6 10	0 15	5 15	85	1 4	0·71	10
„ locust bean	—	—	7 15	0 7	7 8	71	2 1	1·12	3·6
„ bean	—	—	10 10	1 4	9 6	66	2 10	1·52	20
„ fish	—	—	18 0	3 3	14 17	53	5 7	3·00	48
Maize, cooked flaked	—	—	8 10	0 10	8 0	83	1 11	1·03	8·6
„ gluten feed	—	—	7 0	0 19	6 1	76	1 7	0·85	19
Linseed cake, English, 12% oil	—	—	11 0	1 9	9 11	74	2 7	1·38	25
„ „ „ 9% „	—	—	10 2	1 9	8 13	74	2 4	1·25	25
„ „ „ 8% „	—	—	9 17	1 9	8 8	74	2 3	1·20	25
Soya bean cake, 5½% oil ..	—	—	8 17*	2 0	6 17	69	2 0	1.07	36
Cottonseed cake—									
English, 4½% oil	—	—	5 2	1 7	3 15	42	1 9	0·94	17
„ „ Egyptian, 4½%„	—	—	4 12	1 7	3 5	42	1 7	0·85	17
Decorticated cottonseed meal, 7% oil	—	—	10 0*	2 0	8 0	74	2 2	1·16	35
Ground-nut cake, 6-7% oil ..	—	—	6 10†	1 7	5 3	57	1 10	0·98	27
Decorticated ground-nut cake, 6-7% oil	—	—	8 0†	2 1	5 19	73	1 8	0·89	41
Palm kernel cake, 4½-5½% „	—	—	6 0†	0 17	5 3	75	1 4	0·71	17
„ „ „ meal, 4½% „	—	—	6 10†	0 17	5 13	75	1 6	0·80	17
„ „ meal 1-2% oil ..	—	—	5 15†	0 18	3 17	71	1 1	0·58	17
Feeding treacle	—	—	6 7	0 9	5 18	51	2 4	1·25	2·7
Brewers' grains, dried ale ..	—	—	4 17	0 17	4 0	48	1 8	0·89	13
„ „ „ porter	—	—	4 10	0 17	3 13	48	1 6	0·80	13
Malt culms	—	—	7 0§	1 6	5 14	43	2 8	1·43	16

* At Bristol. † At Hull. § At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of May and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £9 per ton, then since its manurial value is 17s. per ton as shown above, the food value per ton is £8 3s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 2d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·16d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N 9s. 0d.; P_2O_5, 3s 2d.; K_2O, 3s. 4d.

MISCELLANEOUS NOTES

Ormskirk Potato Trials, 1930

THE National Institute of Agricultural Botany extends an invitation to farmers, potato growers and merchants, and agricultural advisory and administrative officers, to visit the Potato Testing Station, Ormskirk, singly or in parties on August 12, 1930, or, if this date is inconvenient, on any week-day between August 5 and 16. Besides the usual trials of new varieties of potatoes for immunity from wart disease the Institute is continuing, for the Ministry, investigations into the relative resistance to leaf-roll of a number of varieties, and the possibility of growing in England seed potatoes free from virus diseases. These trials will be open to the inspection of visitors. In addition visitors will be able to see the Lord Derby Gold Medal Trials and Yield and Maturity Trials of the leading early and main crop potatoes. Some of these trials are designed to show the influence of origin of seed on the behaviour of varieties; they also include "virus-free" stocks raised in England. A large number of demonstration plots of British and foreign varieties of potatoes, including those certified as immune in 1928 and 1929, and an interesting series of plots of some common potato synonyms may also be seen.

Secretaries of branches of the National Farmers' Union and others wishing to organize parties to see the trials should write to the Superintendent of Potato Trials, Potato Testing Station, Lathom, Ormskirk, Lancs., suggesting alternative dates. Individual visitors will be equally welcome, but they should inform the Superintendent of the date of their visit not less than a week in advance. Ormskirk is conveniently reached by a frequent service of local trains from either Liverpool or Preston.

* * * * * *

The Agricultural Index Number

THE index number of the prices of agricultural produce during May was 34 per cent. above the level of 1911-13 as compared with 37 per cent. and 44 per cent. respectively a month and a year earlier. The fall of three points on the month was due primarily to the lower prices ruling for fat cattle and pigs, milk and hay.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925:—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	37
May	57	50	42	54	44	34
June	53	48	41	53	40	—
July	49	48	42	45	41	—
August	54	49	42	44	52	—
September	55	55	43	44	52	—
October	53	48	40	39	42	—
November	54	48	37	41	44	—
December	54	46	38	40	43	—

Grain.—Following the slight upward movement which occurred between March and April, prices of wheat and oats again rose during May, the advances amounting to 1d. and 3d. respectively per cwt. In the case of wheat, however, a proportionately greater increase took place in the corresponding period of the base years, with the result that the May index fell by three points to 11 per cent. above pre-war. The index figure for oats was unchanged at 11 per cent. below 1911-13. Quotations for barley continued to recede and the index number was one point lower at 1 per cent. less than pre-war. As compared with a year ago, wheat was cheaper by about 1s. 2d., barley by 2s. 8d., and oats by 3s. 2d. per cwt.

Live Stock.—Values for fat cattle were not maintained during the month under review and the index number was three points lower at 30 per cent. above pre-war. Fat sheep also were slightly cheaper. A further substantial reduction was recorded in fat pig prices and the index for baconers fell by 15 points to 61 per cent. and that for porkers by 13 points to 67 per cent. above the 1911-13 level. Since February, the month in which fat pig prices reached the peak of the rapid and sustained advance dating from the previous October, there has been a fall in values of 3s. per score lb. for baconers and 3s. 6d. for porkers. Dairy cows sold at about the same prices as in April and the index number showed no material alteration at 29 per cent. above the base period. A rise of about 8s. per head took place in quotations for store cattle and the index was four points higher. Store sheep also were dearer at 46 per cent. above pre-war. The downward trend of fat pig prices was not reflected to any appreciable extent in the quotations for store pigs and these were about the same as in April, but as a rise in prices occurred between April and May of the base period, the index number was five points lower at 108 per cent. above pre-war.

Dairy and Poultry Produce.—Milk became a little cheaper on average during May and the index figure fell by three points to 55 per cent. above 1911-13. Cheese, however, was about 5s. per cwt. dearer at 52 per cent. in excess of pre-war. Values for butter were again substantially reduced and the index number dropped by seven points to 23 per cent. above the level of the base period. Prices of eggs also continued to decline during the month under review and the index number was 12 points lower. A year ago, both butter and eggs were 50 per cent. dearer than in 1911-13. Quotations for poultry were higher at 64 per cent. in excess of those of the base years.

Other Commodities.—Prices of potatoes showed a slight recovery from the very low levels ruling in April, but while the index number rose by three points, it was still below pre-war and potatoes were 33 per cent. cheaper than in May, 1929. Clover hay became about 4s. 6d. and meadow hay 3s. 6d. per ton cheaper on the month, and the relative index numbers fell by three and one point to 29 and 27 per cent. respectively above 1911-13. The first consignments of this season's cooking gooseberries were marketed during the month and these were about 10 per cent. cheaper than in May last year.

Index numbers of different commodities during recent months and in May, 1928 and 1929, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13.

Commodity	1928	1929	1930			
	May.	May.	Feb.	Mar.	Apl.	May.
Wheat	40	25	21	12	14	11
Barley	41	34	Nil	—2*	Nil	—1*
Oats..	74	31	—8*	—15*	—11*	—11*
Fat cattle	48	32	37	37	33	30
Fat sheep	90	57	56	52	56	63
Bacon pigs	42	81	95	90	76	61
Pork pigs	40	78	99	96	80	67
Dairy cows..	33	32	31	30	30	29
Store cattle..	26	23	26	26	24	28
Store sheep..	50	51	49	48	43	46
Store pigs	26	81	135	125	113	108
Eggs	35	50	51	31	40	28
Poultry	51	65	41	52	55	64
Milk	53	57	67	55	58	55
Butter	52	50	43	37	30	23
Cheese	85	81	39	40	41	52
Potatoes	120	—3*	—14*	—24*	—39*	—36*
Hay	14	22	34	34	30	28
Wool	72	59	18	11	3	Nil.

* Decrease.

Export of Breeding Stock

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland *during* the three months ended March, 1930, *compared* with the corresponding period of 1929. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	Jan. to March, 1930		Jan. to March, 1929	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	23	2,757	17	2,040
Belgium	53	2,526	0	0
Chile	4	227	7	1,027
Uruguay	2	605	2	300
Australia..	50	5,823	0	0
Hong Kong	19	800	0	0
Irish Free State.. ..	482	11,976	429	12,609
Kenya	2	137	26	1,417
Southern Rhodesia ..	27	2,249	48	3,240
Union of South Africa ..	33	2,171	17	1,292
Other countries	12	815	8	896
Total	707	30,086	554	22,821
SHEEP AND LAMBS				
Argentina	131	3,100	201	4,870
Chile	16	1,140	8	289
Colombia	0	0	7	140
Peru	0	0	16	200
United States of America	48	877	2	50
Uruguay	3	420	19	330
Australia..	20	405	0	0
Irish Free State.. ..	10	238	6	50
Union of South Africa ..	2	55	3	96
Other countries	3	58	4	153
Total	233	6,293	266	6,178
SWINE				
Belgium	21	324	0	0
Brazil	3	110	0	0
Egypt	75	275	0	0
Germany..	1	35	21	187
Hungary	0	0	26	105
Peru	0	0	6	114
Australia..	7	197	0	0
Irish Free State.. ..	46	274	37	251
Kenya	0	0	14	251
Southern Rhodesia ..	10	300	0	0
Other countries	4	118	17	371
Total	167	1,633	121	1,279

Soil Science: Imperial Conference

A CONFERENCE of Empire Workers in Soil Science will be held at Rothamsted Experimental Station on September 16, 17 and 18 next. The preliminary programme has been arranged, and the first day will be devoted to an inspection of the classical plots on the Rothamsted Farm and of the Laboratories at the Station. On that day also the Rt. Hon. W. G. A. Ormesby-Gore, P.C., M.P., will formally open the Conference. The remaining two days will be occupied in discussions. On September 17 the subjects "The Present Position of Soil Analysis" and the "Work of the Imperial Bureau of Soil Science" will be taken in the morning and afternoon Sessions respectively; in the evening a joint Meeting with the British Empire Section of the International Society of Soil Science and the Soils Sub-Committee of the Agricultural Education Association will be held, at which "Present Day Soil Problems" will be discussed. On September 18 the morning will be devoted to various aspects of "Soil Surveys" and the afternoon to "Methods of Field Experimentation."

Those proposing to attend the Conference should apply to the Imperial Bureau of Soil Science, Rothamsted Experimental Station, Harpenden, Herts., when full particulars will be sent to them. The Bureau hopes that members of the Conference will keep the evenings free to permit of the discussion of special problems by small groups of workers.

* * * * * *

Stud Goat Scheme, 1929-30

THE report on the operation of this Scheme during its sixth season shows that substantial progress has been achieved in several directions. Thirty-seven counties were represented, two, Rutland and Westmorland, for the first time. The goats registered numbered 105, classified as follows:—British 51, British Saanen 17, Anglo-Nubian 11, British Toggenburg 9, British Alpine 7, Saanen 6 and Toggenburg 4. As an indication of the type of animal accepted under the Scheme, it may be mentioned that 44 were "dagger" males*, 17 had a "dagger" male as sire, 11 had an imported billy as sire and a Star or Q Star nanny as dam, 9 had a Star or Q Star goat as dam, 5 had an imported male as sire, while 3 were imported in 1922. Thirteen stud goats were stationed in Wales, as compared with 8 and 3 respectively during the

* *i.e.*, billies whose dams, and (on the sire's side) granddams, have secured the Star or Q Star, indicative of descent from good milking stock.

fourth and fifth seasons. Five more goats were registered in County Durham than in 1928-9, bringing the total up to 14, all of which qualified for full premium. Services for the year show an increase of 142, the maximum premium being earned by 47 goats: both these figures constitute records.

The progress of the Scheme, which is very efficiently managed by the British Goat Society, may be seen in the following table:—

Season	Services allowed for premium	Administrative expenses	Travelling expenses	Total	Total cost per service allowed	Average cost per service allowed	Average cost of premium per service
		£ s. d.	£ s. d.	£ s. d.	s. d.	s. d.	s. d.
1924–25	841	50 0 0	66 3 3	116 3 3	7 2½	2 9	4 5½
1925–26	1,077	50 0 0	71 7 8	121 7 8	6 5	2 2	4 3
1926–27	1,496	50 0 0	67 10 4	117 10 4	5 7¾	1 7	4 0¾
1927–28	1,491	50 0 0	74 6 10	124 6 10	5 8½	1 8	4 0½
1928–29	1,719	57 16 3	75 0 0	132 16 3	5 4¼	1 7	3 9¼
1929–30	1,861	59 9 9	73 14 8	133 4 5	5 4½	1 5¼	3 11¼

* * * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on June 3, 1930, at 7 Whitehall Place, London, S.W. 1., the Rt. Hon. the Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates and proceeded to make the following Orders carrying into effect the Committees' decisions.

Dorset.—An Order continuing as from June 8, 1930, until June 6, 1931, the operation of the existing minimum and overtime rates of wages. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 31 hours in the week in which Christmas Day and Boxing day fall, and 42 hours in the weeks in which Good Friday, Easter Monday, Whit Monday and August Bank Holiday fall, with in addition in each of these weeks not more than three hours' employment in connection with milking and the care of and attendance upon stock on each public holiday. In any other week in winter the minimum weekly wage is payable in respect of 48 hours and in any other week in summer in respect of 51 hours. The overtime rate for male workers of 21 years of age and over is 8d. per hour. In the case of whole-time female workers of 21 years of age and over the minimum rate is 24s. per week of 31 hours in the week in which Christmas Day and Boxing Day fall; and 39½ hours in the weeks in which Good Friday, Easter Monday, Whit Monday and August Bank Holiday fall, with in addition in each of these weeks not more than three hours' employment in connection with milking and the care of and attendance upon stock on each holiday. In any other week the minimum weekly wage is payable in respect of 48 hours. The overtime rate for whole-time

female workers of 20 years of age and over is 6d. per hour. In the case of part-time and casual female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6d. per hour.

Hertfordshire.—(1) An Order fixing special differential rates of wages for overtime employment on the Hay Harvest in 1930. The overtime rate in the case of male workers of 21 years of age and over is 10d. per hour and in the case of female workers of 19 years of age and over 7¾d. per hour.

(2) An Order fixing special minimum rates of wages for employment on the Corn Harvest in 1930. The minimum rate in the case of male workers of 21 years of age and over is 10½d. per hour and in the case of female workers of 21 years of age and over 7½d. per hour.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

* * * * * *

Enforcement of Minimum Rates of Wages.—During the month ending June 14 legal proceedings were instituted against 14 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

County	Court	Fines	Costs	Arrears of wages	No. of workers involved
		£ s. d.	£ s. d.	£ s. d.	
Cheshire ..	Birkenhead ..	20 0 0	12 10 0	63 2 0	10
,, ..	,, ..	4 10 0	7 13 0	39 1 1	9
Monmouth ..	Abergavenny	1 0 0	5 5 0	12 0 0	2
,, ..	,,	0 5 0	—	1 17 1	1
,,	Usk	(a)	1 9 6	17 0 0	1
Nottingham	Newark ..	2 0 0	—	13 18 3	1
Stafford ..	Stafford ..	(b) 10 0	0 5 0	40 11 0	2
Worcester ..	Droitwich ..	6 0 0	5 7 0	13 14 6	4
West Riding	Rotherham .	(c)	—	0 3 0	1
,,	Ingleton ..	(a)	0 10 6	12 6 2	1
Denbigh ..	Ruthin ..	(d) 8 0	—	3 0 0	2
Radnor ..	Clyro ..	(a)	0 4 0	20 0 0	1
,, ..	,, ..	(a)	0 4 0	8 0 0	1
,, ..	,, ..	1 0 0	0 4 0	15 0 0	1
		£35 13 0	£33 12 0	£259 13 1	37

(a) Conviction recorded.
(b) Case of one worker withdrawn on payment of arrears.
(c) Dismissed under the Probation of Offenders Act.
(d) Case of one worker dismissed.

* * * * * *

APPOINTMENTS

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES.

Midland Agricultural College, Sutton Bonington.—Mr. H. S. Hall has been appointed Lecturer in Engineering, *vice* Mr. G. R. Hunter, B.Sc. (deceased).

Miss D. V. S. Lamb, N.D.D., has been appointed Assistant in the Dairy, *vice* Miss E. M. Crossley, N.D.D.

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

Cambridgeshire: Mr. J. A. McMillan, B.Sc., has been appointed Agricultural Organizer, *vice* Mr. J. C. Leslie, M.A., B.Sc.

Cumberland and Westmorland: Mr. C. M. Robertson* has been appointed Assistant Instructor in Horticulture.

Mr. W. E. Watson, N.D.A., has been appointed Warden Record Keeper of the Newton Rigg Farm Institute.

Dorset: Miss L. M. Stanger, N.D.A., N.D.D., has been appointed Instructress in Dairying, *vice* Miss E. Bucknell, N.D.A., N.D.D., who has been promoted to Senior Dairying Instructress in place of Miss H. Balch, N.D.D.

Hertfordshire: Mr. L. F. Clift has been appointed Assistant Instructor in Horticulture.

Lancashire: Mr. T. B. Evans, B.Sc., and Mr. W. B. Nicoll, B.Sc., have been appointed District Agricultural Organizers.

Mr. F. Procter, M.A., has been appointed Dairy Bacteriologist.

Staffordshire: Mr. L. J. Shelley has been appointed Assistant Lecturer in Poultry Keeping.

Suffolk West: Mr. R. Sayce, B.Sc., N.D.A., has been appointed Agricultural Organizer.

Warwickshire: Mr. J. E. Bull, N.D.A., has been appointed Assistant Agricultural Organizer.

Miss A. Ironside, N.D.D., has been appointed Woman Agricultural Assistant.

* Wholly employed by the County Council, but only partially on agricultural education work.

WALES

Carmarthenshire: Miss Eira Jones has been appointed Instructress in Rural Domestic Science.

* * * * * *

BOOK NOTICE

A Text Book of Dairy Chemistry. By Edgar R. Ling, M.Sc. (Lond.), A.R.C.S., F.I.C. Pp. vi + 213. Illus. (London. Chapman & Hall, Ltd. 1930. Price 6s. net.)

The author of this book is lecturer in agricultural chemistry at the Midland Agricultural College, and the material here presented has been largely drawn from a course of lectures delivered at the College. It has been prepared to meet the needs of students of agriculture and dairying, and is written on the assumption that readers will already possess some knowledge of chemistry and physics. It is hoped, however, that with the guidance of a tutor, the book may prove useful to those who are not so equipped. The references at the end of each chapter supply guidance for further reading for those who wish to pursue the subject.

The book is divided into two sections, Theoretical and Practical, the former covering the constituents and composition of milk, milk products, butter, cheese and dairy by-products, and the action of heat on milk and of milk on metals; and the latter dealing with analysis as applied to milk and its products. The subject is, therefore, completely covered, and, while dairy chemistry is, as Mr. Ling says in his preface, one that is liable to become one of the most difficult sections of the curriculum, his book should do something to make its difficulties less insuperable.

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NOTES FOR THE MONTH

A Birmingham Small Holders' Estate

ONE of the most striking achievements of the post-War scheme for the settlement of ex-servicemen on the land is that of the City of Birmingham, at Canwell.

The responsibility for providing small holdings to meet the needs of suitable ex-service applicants was placed by Parliament on County Councils and County Borough Councils. All the County Councils in England and Wales responded to the demand, but only about a score of the County Boroughs acquired any land for this purpose, and of these the City of Birmingham was responsible for more than half of the total area provided. The demand for holdings from ex-servicemen resident in Birmingham was considerable, and the Council, anxious to do its utmost to meet their needs, took the bold step of purchasing a large estate of 3,600 acres at Canwell, a few miles outside the City. This was the largest single purchase made under the Land Settlement Scheme, a remarkable fact when it is remembered that the purchasing council was pre-eminently urban in character and had no agricultural staff and but few members with agricultural experience. To such a body the development of the estate presented a formidable problem, but the work was tackled with energy and ability, and, thanks largely to the untiring enthusiasm of the Chairman of the Agricultural and Small Holdings Committee (Alderman T. Quinney, J.P.), has been carried to a successful conclusion.

A small area of unsuitable land was disposed of and the remainder, 3,345 acres, was divided into nearly 140 small holdings. The estate originally comprised 16 farms and about 70 cottages. The existing houses and buildings were adapted to meet the requirements of the new holdings, and an additional 58 houses and about 90 buildings were erected by the Council. Much expenditure was also required on fencing and on the seven miles of roads comprised in the developed estate. No less than 10 miles of water mains had to be

laid to ensure an adequate supply of pure water for the new settlers. Altogether the total cost of purchase and equipment of the estate amounted to a quarter of a million pounds.

The new holdings were nearly all equipped with a house or cottage, and with buildings suitable to their type and size. They vary in area from 1 to 50 acres, and in type from small market-garden or poultry holdings to fully-equipped and self-supporting arable, mixed or dairy holdings. As a result of the Council's efforts, the estate now supports a population nearly double that maintained before its conversion into small holdings, and there is little doubt that its productivity has also increased.

Interesting features about the progress of this small holding colony are the development and achievements of the association formed by the tenants, and known as the Canwell Estate Agricultural Society. The primary object of the Society, membership of which is confined to residents on the estate, is the organization of an annual agricultural and horticultural show on the Estate, and this has grown from the first modest effort in 1925 until it is now a considerable and well-attended show, in which the exhibits attain a high standard. The sixth annual show is being held at Canwell on August 7. The show is organized entirely by the tenants' society, and the exhibits are divided this year into six sections comprising over 120 classes. Numerous competitions (horse leaping, riding classes, etc.) are also held. The increasing importance and success of the show reflects great credit on the organizers, just as the prosperity of the estate generally is a source of legitimate pride to the enterprising City and its able Committee.

* * * * * *

Better Milk and the Health Visitor

AN interesting and useful course of instruction to Health Visitors on the Food Value and Care of Milk, particularly in relation to Graded Milks, was recently concluded at Armstrong College, Newcastle-upon-Tyne. The reasons which led up to the institution of this Course may be of interest.

In recent years an intensive campaign of Clean Milk Production has been carried on in the North of England, in common with other areas of the country. Annually recurring County Clean Milk Competitions, Milkers' Competitions and Clean Milk Demonstrations have been a feature in each of the counties. Periodical courses for sanitary inspectors in up-to-date methods of milk hygiene, for the purpose of assisting

these officers in their duties under the Milk and Dairies Order, 1926, have been a prominent factor in the progress made. The cumulative effect of these activities has been a silent revolution in methods on many of the dairy farms in Northumberland, Durham, Cumberland and Westmorland, 60 licences for the production of graded milks having been issued in this area, and a corresponding number of potential producers of such graded milk having been brought into existence.

The apathy of the consuming public is the limiting factor which threatens to retard further progress in this direction, and it has become evident that unless the value of better milk is better realized by the laity, little further effort on the part of the producers of milk can reasonably be expected. In Durham and Northumberland, good production has, in fact, preceded and outrun good demand. In order to restore the balance it was decided to approach local health authorities with a view to spreading the gospel of clean milk consumption. Valuable help might be expected, particularly from health visitors, district nurses and other welfare workers who enter the homes of the people in an advisory capacity—more particularly those homes in which infants and invalids are to be found—and the institution of a course of instruction to health visitors on the food value and care of milk would carry appropriate information on the value and importance of the best milk to that section of the community which, above all others, requires it.

Such a course or series of courses would serve two purposes. On the one hand, health and physique would be improved by stimulating the consumption of the best milk. As the Chief Medical Officer of the Ministry of Health has said in one of his Annual Reports: "There should be no relaxation of effort in advocating its increased consumption until the daily rate per capita of the whole population reaches one pint." On the other hand, by increasing the demand for better milk, the proposed courses for health visitors would stimulate and encourage the progressive dairymen to go forward with the work of better milk production. An influential committee was formed including prominent Tyneside Medical Officers of Health, Sanitary Inspectors, representatives of the National Farmers' Union in Durham and Northumberland, together with the officers concerned with agricultural education in the area. This committee appointed as its Secretary the Secretary of the Northumberland County branch of the

National Farmers' Union, to whom much of the credit for the successful issue of the course is due. The first course began in the early part of the present year and a satisfactory entry of 40 health visitors was secured, the majority being drawn from the City of Newcastle and the County Borough of Sunderland, two of the principal consuming centres in the North.

The course was advertised as arranged under the auspices of the Northern Branch of the Society of Medical Officers of Health. It comprised four evening lectures and two afternoon visits to selected dairy farms in Durham and Northumberland. A fee of 10s. 6d. was charged, exclusive of travelling expenses.

The lectures included (1) the value of milk as a food, delivered by a medical officer of the Newcastle Corporation ; (2) the law relating to milk supplies, by the Medical Officer of Health for Sunderland ; (3) a demonstration in milk cookery, given by the National Milk Publicity Council ; and (4) modern dairy hygiene, by the Lecturer in Dairying attached to the Agricultural Department of Armstrong College, Newcastle-upon-Tyne, who also conducted the visits to farms. The course was quite successful : it aroused much interest among those attending it, who were very appreciative. Thanks are due to all concerned ; in particular to the Secretary of the Northumberland County Branch of the National Farmers' Union who organized the course, and to the Professor and staff of the Agricultural Department of Armstrong College for help and facilities afforded.

As there are large numbers of health visitors attached to the county councils and local authorities in the industrial north, further courses of a similar character are under consideration.

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Public Rights and Rural Commons

THE Minister frequently receives from lords of manors and other persons entitled to the soil of common land in rural areas, complaints as to the disfigurement and spoliation of the commons through camping by gipsies and others, the lighting of fires, the driving of vehicles over the land, the deposit of litter, and other nuisances.

The Minister desires, therefore, to draw attention to the fact that the provisions of section 193 of the Law of Property Act, 1925, may be applied by the lord of the manor, or other person entitled to the soil of any such land which, on January 1, 1926, was subject to rights of common, by a deed of declaration, revocable or irrevocable, to be deposited with the Ministry.

The effect of such a deed, while giving the public rights of access for air and exercise, is to render liable to a penalty any person who unlawfully drives a vehicle over the common, or camps, or lights fires thereon.

Moreover, the Minister has power to impose such limitations on and conditions as to the exercise of the public right of access as may seem necessary or desirable for preventing the interests of the owners of the soil or of the common rights from being prejudiced through any other causes in addition to those already mentioned as, for example, the deposit of litter, the damaging or uprooting of trees, heather, plants, etc.

The Minister feels that lords of manors and others would have no objection to granting the public access for air and exercise to rural commons, provided that this right was not abused, and the Ministry will be ready to supply any inquirers with information and directions as to the procedure which should be adopted to achieve this result. Letters in this connection should be addressed to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

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THE following note has been communicated by Mr. V. C. Fishwick, P.A.S.I., N.D.A., N.D.D., of the South-Eastern Agricultural College, Wye, Kent.

Feeding of Sows and Their Litters

During a recent survey of a considerable number of pig farms, it was noted that scour, a disorder which occasions serious loss of growth and condition in piglings, often occurred on farms where sows and litters were liberally fed with rations having a comparatively high protein content. Conversely, scour was generally absent upon farms where the breeding stock was not so "highly" fed. The inference seemed to be that, in the endeavour to promote rapid growth, some breeders were over-feeding their stock, and a critical examination was therefore made in regard to rations fed to sows and litters, and served to disclose three probable sources of error.

The first concerns the feeding of in-pig sows, which many breeders erroneously believe need a ration rich in protein. A young pig at birth weighs about 3 lb., so that a sow bearing 10 piglings has to produce 30 lb. live-weight increase during

her gestation period of 114 days, *i.e.*, approximately ¼ lb. per day. No data appears to be available as to the amount of digestible protein required by a sow for production purposes, but it may be pointed out that a growing pig of 30–40 lb. live-weight can produce ¼ lb. live-weight increase on a ration containing ⅛ lb. digestible protein, and there seems no reason to suppose that a sow requires more. For her own maintenance, an adult sow requires about ½ lb. (0.5 lb.) digestible protein per day; add to this ⅛ lb. (0.12 lb.) for production, and we get ⅝ lb. (0.62 lb.) as the average daily requirement in digestible protein of an in-pig sow, the amount being smaller at the beginning and slightly larger at the end of the gestation period. This estimate has been checked at Wye, and ample evidence has been obtained to show that it is not too low. During the past winter, in-pig sows in the College experimental herd received 5 lb. per head per day of a ration containing 12 per cent. of digestible protein (0.6 lb.), the amount being increased to 6 lb. (0.72 lb.) at the end of the gestation period. Normal pigs were produced and the sows were in good condition. These figures are further confirmed by data obtained from a commercial farm, where similar feeding, followed for several winters in succession, has given very satisfactory results.

The following table gives three rations for in-pig sows, No. 1 being that used at Wye last winter :—

Rations for In-pig Sows.

	No. 1. per cent.	*No.* 2. per cent.	*No.* 2a. per cent.
Barley meal	30	30	35
Sharps	55	60	60
Bran	5	—	—
Germ maize meal	5	—	—
Fish meal	5	10	5
With an addition to Ration No. 1 (per 100 lb. of meal) of			
Ground chalk .. 1½ lb.			
Salt .. .. .. ½ lb.			
Digestible protein content ..	12	14	12

No. 2 ration, containing 14 per cent. of digestible protein, is at present in common use by breeders, many of whom during the winter months feed 6 lb. of meal per head daily, whilst others, who wish to do their sows well, give 7 or 8 lb. Six pounds of such a ration as No. 2 contains 0.84 lb. of digestible protein, which is in excess of the requirements of an in-pig sow, and 7 lb. will contain 0.98 lb. of digestible protein, or 50 per cent. more protein than the sow requires. The cost of protein being comparatively high, rations of similar nature

to Nos. 1 and 2A are not only cheaper but safer than those which, like No. 2, contain a higher percentage of protein.

The second point concerns the feeding of the sow while suckling. It has been repeatedly demonstrated at Wye that it is possible to influence the "nature" of the sow's milk by feeding. Data on this point, although not abundant, are significant. Thus, if 2–3 oz. of Epsom salts are fed to a nursing sow the piglings she is suckling will scour within 24–28 hours. Also, if 2–3 oz. of chalk are added to the ration of a nursing sow, the dung of her piglings becomes noticeably firmer at the end of 24 hours; and, if the chalk is continued for two or three days, the dung becomes hard and there is a tendency to constipation. It is logical to infer that other things may affect the nature of the sow's milk. There are, however, three points regarding feeding which, from the writer's observations, appear worthy of mention.

(*a*) It would appear wise to use only tried and suitable feeding stuffs to build up a ration, avoiding damaged, fermented or untried feeding stuffs, however cheap they may appear.

(*b*) Over-feeding should be avoided. A nursing sow decreases her milk only if greatly underfed; if she is only slightly underfed, her milk supply will not diminish, although she may lose condition, but this will be recovered quickly after the piglings are weaned. Over-feeding, however, is liable to cause digestive troubles which may affect both the quantity and quality of the milk, even if it produces no external symptoms. The sow should receive only what she will clear up readily, not all that she will eat.

(*c*) The sow's ration should not be changed during the nursing period.

The third point concerns the feeding of the young pigs. That it is dangerous to feed "rich" foods to young animals is generally accepted, but the principle is often violated in the case of piglings, which are allowed, and even encouraged, to eat rations containing a large proportion of highly-concentrated food such as fish meal. At Wye, such a ration, given when the young pigs start to eat, has been found to cause scour. A "simpler" starting diet appears desirable, therefore, and has proved satisfactory at this centre, where, also, arrangements are made to prevent the piglings from eating their mother's food and *vice versa*. This is effected by feeding the sow in a small trough with high sides, into which the piglings are unable to climb while the sow is feeding. The piglings, in turn, get their special ration from a low trough

behind a creep which the sow cannot pass. This ration starts with sharps, and as soon as the young pigs begin to eat the sharps, a mixture composed of equal parts of barley meal and sharps is substituted. This is continued until the piglings have been eating well for several days, and are consuming 1 or 2 lb. of food per litter per day. Then a second change is made to a mixture composed of barley meal, 45 per cent.; sharps, 45 per cent.; and linseed cake meal, 10 per cent., with an addition, to each 100 lb. of this meal, of 1½ lb. of chalk and ½ lb. of salt. This ration is continued until weaning, when the sharps is reduced to 40 per cent., 5 per cent. of fish meal being added. Fresh food is put into the piglings' trough twice a day, any uneaten portion of the previous feed being removed.

The age at which piglings start to eat varies considerably with different litters and appears to depend upon the milking capacity of the sow. With large black sows, the piglings usually start to nibble at about four weeks old, and are usually ready to take the linseed cake ration at from 5 to 6 weeks of age.

Some breeders may urge that such a system is too troublesome for the ordinary farm, but, in point of fact, if the pigman is reasonably intelligent, and can be got to take an interest in the method, it will be found to take but little, if any, more time than any other efficient method of feeding young pigs.

The writer desires to express his thanks to Mr. V. R. S. Vickers, Vice-Principal of the College, for much help in connexion with these particulars.

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Cash on Delivery Service

THE Postmaster-General announces an important extension of the Cash on Delivery Service which should be of particular benefit to farmers, smallholders and market gardeners. Highly perishable goods, such as meat, soft fruit, and cut flowers, up to a maximum weight of 2 cwt., may, as from July 1 last, be sent C.O.D. by passenger train, the amount being collected by the Post Office under the existing system and remitted without delay to the consignor.

The Ministry, in conjunction with the Post Office, has issued a pamphlet describing how the producer can use the C.O.D. service for selling farm and garden produce direct to the consumer and the best methods of packing the products. A copy of the pamphlet may be obtained free of charge on application to any Head Post Office and the principal Post Offices in country districts.

Demonstrations of Combine Harvesters

THE Ministry, in conjunction with the Kesteven Agricultural Education Authority, is arranging to carry out, during the coming harvest, demonstrations of a number of combine harvesters near Wellingore, Lincolnshire. The machines will be of British, American and, it is also hoped, Australian manufacture.

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Farm Institute Livestock Judging Competition

THE fourth annual competition in the judging of livestock open to students of Farm Institutes in England and Wales was held on June 5 last, under ideal conditions, on the farm of Mr. James de Rothschild, M.P., at Waddesdon, near Aylesbury. As in previous years the competition was managed by a committee representative of the National Farmers' Union, the Royal Agricultural Society of England, the County Councils' Association and the Ministry. The judges, four in number, were again appointed by the Ministry in consultation with the committee.

The five classes of stock judged in this competition were Shorthorn dairy cows in milk, Shire horses, Saddleback gilt pigs, Southdown-Kent cross sheep in the wool, and Light Sussex poultry. The judges placed the stock shown in order of merit before the competition began and competitors were expected to decide what they considered the right order, directing their attention especially to commercial value rather than to breed points. Six of the seven Farm Institutes which competed last year again sent teams, viz., the Cheshire School of Agriculture (Reaseheath), the Denbighshire Farm Institute (Llysfasi), the Monmouthshire Agricultural Institute (Usk), the Northamptonshire Farm Institute (Moulton), the Staffordshire Farm Institute (Rodbaston), and the Suffolk Agricultural Institute (Chadacre); the Cumberland and Westmorland Farm School (Newton Rigg) and the East Sussex Farm Institute (Wales Farm, Plumpton), which did not compete last year, were also represented. Each team consisted of three; they were allowed ten minutes to inspect, handle and place the animals in each class, and a further ten minutes for giving in writing their reasons for so placing them. Afterwards each judge gave the reasons for his decisions.

The perpetual challenge cup provided by the National Farmers' Union was won by the Monmouthshire Institute,

the Cheshire and the Cumberland and Westmorland Institute teams winning respectively the second and third places. The competition was a very keen one, only 73 marks out of a possible total of 365 separating the first and last of the competing teams.

Captain Morris, President of the National Farmers' Union, in presenting the Cup to the winning team, gave a most inspiring address, while the Chairman of the Education Committee of the National Farmers' Union was also present and addressed the competitors. The facilities provided by Mr. Rothschild were excellent, and the whole-hearted co-operation by Mr. Rothschild's agent and the Secretary of the local branch of the National Farmers' Union did much to contribute to the success of the proceedings.

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Lectures by Professor Wiegner

FOR many years a scheme has been in operation under which fellowships are awarded to agricultural research workers in this country to enable them to visit foreign scientific laboratories, experiment stations, etc., in order that they may keep abreast of the progress made and the technique employed by foreign workers in the subjects with which they are concerned. These fellowships have been awarded by the Ministry on the recommendation of the Advisory Committee on Agricultural Science of the Development Commission, and the scheme has been most successful.

It is, however, possible for only a few workers to leave their research institutes in any year for foreign travel. It has been suggested, therefore, that as a counterpart to this scheme, foreign scientists of pre-eminence in their respective spheres should be invited to this country for the dual purpose of giving an account of their work to research workers, and of discussing with these workers their various problems and methods of attack, and giving them helpful criticism.

The experiment was accordingly tried in June, 1930, of inviting to this country Professor Georg Wiegner of the Technische Hochschule, Zurich, who is in charge of the Agricultural Chemistry Department at that School, and who is not only distinguished for his researches on the nature and properties of clay, but who is also a stimulating teacher and lecturer in other aspects of soil science. The chief centres of soil research in Great Britain are at the Rothamsted Experimental Station, and at Cambridge, Leeds, Bangor, Edinburgh and Aberdeen.

Arrangements were accordingly made for Professor Wiegner to visit these centres for the purpose of delivering lectures to the soil workers and discussing their problems with them. Three weeks were spent by Professor Wiegner in this way. His lectures were concerned with (1) the base change in soils; (2) the hydrogen clay; (3) coagulation. Those given at Rothamsted are to be published (in English) by the Society of Chemical Industry. In his inspection of the various laboratories, Professor Wiegner talked not only with the heads of Departments but also with the junior staffs, discussing their work with them and pointing out directions in which methods and results differed from those of other laboratories.

The reports from those in charge of the centres visited by Professor Wiegner are unanimous as to the value of the visit to soil research and to advisory workers. On the other hand, it is gratifying to learn from a report by Professor Wiegner himself to the Ministry that he was favourably impressed with the position of agro-chemical and agricultural research in Great Britain.

The Ministry's cordial thanks are due to Professor Wiegner, and also to Sir John Russell, who made the proposal to invite Professor Wiegner and undertook the arrangements in connexion with the visit.

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Stubble Cleaning

THE following note has been communicated by Mr. A. W. Oldershaw, B.Sc., Agricultural Organizer for East Suffolk :—

The tractor has greatly helped the post-war farmer in keeping his land clean, and never is the tractor of more value than after the stubbles are cleared. Some farmers even take a man off the harvest so that he may start the tractor on the stubbles immediately the first harvested crop is removed. Any implement which breaks up the stubbles and exposes the roots of weeds to sun and wind is of value. The actual tool most suitable must depend to a great extent upon the character of the land. Implements which stir the ground without actually inverting it are favoured under some circumstances. The steam cultivator is typical of this kind of implement, but, unfortunately, owing to the limited number of sets of steam tackle available it can only be used on a comparatively small acreage in the very short time after harvest. In heavy-land districts it is invaluable when the weather remains dry for some weeks after the stubbles are cleared. Cultivators requiring less power to draw them may do useful work where the conditions are favourable; and even a

comparatively light implement drawn across the stubbles will make sufficient tilth to encourage weed seeds to germinate. As a rule, however, it is best to use an implement which will penetrate the soil and turn up a good clod, and the plough will often do this better than anything else.

For dealing with many weeds, such as twitch or couch grass, bent, etc., it is essential to separate the freshly-formed clod from the soil below. The plough with a "rimpling" or "riffling" breast is excellent for dealing with couch grass, especially perhaps on light land. There is no doubt that the most important matter is to get all the stubbles moved as quickly as possible, as soon as they are cleared. For this purpose it is an excellent plan, wherever possible and the weather is favourable, to have the tractor worked in shifts, so that it is occupied for the whole period of daylight. In such a case, during a spell of favourable weather, as occurred in most districts in the autumns of 1928 and 1929, what almost amounts to a fallow may be made on the stubbles. The advantage gained by tilling the stubbles immediately they are cleared is not limited to killing weeds and causing weed seeds to germinate.

As soon as the smothering effect of the crop is removed, all weeds make rapid growth, especially if there is enough moisture present. This growth is stopped to a great extent when the stubbles are moved, especially in dry weather. In a wet autumn, or in late seasons or districts, it seems likely that the best treatment for stubbles is the plough, which, by inverting and burying weeds, checks all growth for weeks. Some weeds are killed, while others of creeping habit, such as couch grass and its allies, are greatly checked in growth. Some years ago, a case came to the writer's notice in which, in a wet autumn, part of a field was ploughed immediately after harvest, while the remainder was left unploughed until November. In spring, when the land was being worked for mangolds, an inspection showed that there was much more rubbish—chiefly couch grass—in that part of the field that was not ploughed until November. The grass on the unploughed land had made enormous growth in the wet autumn, but where it had been ploughed early growth was greatly checked, the difference being so marked that on walking across the field the writer inquired of the farmer the reason for the comparative absence of weeds on one side of the field.

It seems, therefore, that the policy adopted by many arable farmers of working the stubbles in some way immediately the

crop is harvested is thoroughly sound. The ideal to be aimed at —in some cases already reached—is to carry out some form of stubble cleaning on every field on the farm, within as short a time as possible after the stubbles are cleared. The ideal was in most cases impossible of attainment before the introduction of the tractor, but it is now possible, if sufficient labour is available to keep the tractor at work to its fullest capacity during, as well as after, harvest.

Slender Foxtail.—In some localities, great trouble is experienced with particular weeds. Slender foxtail grass, or, as it is called in some districts, corn foxtail, blackgrass, or land grass (*Alopecurus agrestis*), is a case in point. This weed is a great pest in autumn-sown crops, especially cereals. Long* points out that it has a long period of flowering and ripens its seed towards the end of summer. As the seeds are usually ripe before harvest it is difficult to reduce it. Even after a fallow it often appears in great abundance in autumn-sown wheat. Germination of its seeds frequently does not take place until the autumn rains, after the wheat is drilled. There is very little doubt that small rains during summer, to germinate weed seeds, the seedlings from which can then be destroyed, are an advantage on fallow ground. Where winter beans have been drilled a good width apart much of this weed can be destroyed by means of the horse and hand hoes, but in cereals drilled in narrow rows it may constitute a very serious problem. Where the weed is abundant, working of the surface in autumn may cause the seeds to germinate directly there is enough moisture. After germination the seedlings are easily killed by ploughing under. If the land is full of seeds a fresh crop of seedlings will very likely appear after ploughing. Given suitable weather, probably the best plan to reduce the pest is surface cultivation to germinate seeds on the surface, then ploughing to bury the seedlings. If after this ploughing the land can be left for a time until another crop of seedlings appears, these seedlings may be destroyed by harrowing and the surface soil left fairly free from foxtail seeds. The corn may then be drilled with a reasonable prospect of being fairly free from this weed. It often happens, however, on heavy land, in autumn, that wheat must be put in early lest heavy rain should render drilling difficult, if not impossible. In such circumstances wheat and foxtail very often come up together. It is no easy matter to get rid of slender foxtail on really sticky clay soil, on which one must either drill early in autumn or not at all.

* *Common Weeds of Farm and Garden*, H. C. Long. (John Murray, 1910.)

World Tractor Trials

THE venue of the public demonstrations in connection with the World Agricultural Tractor Trials, which are to be held in England under the auspices of the Royal Agricultural Society, has been transferred from Wallingford to Ardington, near Wantage, with the object of securing stronger and deeper soil for very thorough ploughing tests.

These public demonstrations, at which over thirty tractors from England, America, France, Germany and other countries will be seen at work under the most stringent conditions, are to be held from September 16 to 19 inclusive. Particulars of the arrangements may be obtained from the Secretary, Tractor Trials, 37a St. Giles', Oxford.

Prolonged scientific tests are now being conducted in private by the Institute of Agricultural Engineering, Oxford University, and, in due course, official reports dealing with such points as load capacity, fuel consumption, ploughing, cultivation and road work will be issued for the guidance of farmers and other prospective buyers.

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Imperial Horticultural Conference

A previous note about the Imperial Horticultural Research Conference appeared in this Journal for May last (p. 110). The provisional programme has now been received. Arrangements have been made for the meetings to be held at the Conference Hall of the Royal Society of Arts, John Street, Adelphi, London, W.C.2. Private business of the Imperial Bureau of Fruit Production will be discussed before 11.0 a.m. on Tuesday, August 5, and thereafter the meetings will be open to the public, to whom, as well as to the Press, a cordial invitation is extended to attend. There will be six sessions of the Conference, lasting from 10.0 a.m. to 1.0 p.m. and from 2.30 p.m. to 5.0 p.m. on each of the three days, August 5-7.

The object of the Conference is to discuss the best methods of approach to horticultural problems and the technique involved. The different aspects of these questions will be discussed by the leading horticultural experts of the Empire, some of whom will give their experience of horticultural research in their respective countries. The method of field experiment and the application of pure science to horticultural problems under different climatic conditions as well as the progress of fruit storage methods are also included among

the items in the programme, and a number of papers bearing on these, amongst other phases of the subject, has already been promised. Copies of the full programme can be obtained on application to the Imperial Bureau of Fruit Production, Research Station, East Malling, Kent, or to the Executive Council of the Imperial Agricultural Bureaux, 2, Queen Anne's Gate Buildings, Westminster, S.W.1.

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Re-assessment of Annual Grants to Institutions of Higher Agricultural Education

THE Minister has appointed Earl De La Warr, Parliamentary Secretary to the Ministry, to succeed him as Chairman of the Committee appointed by his predecessor in March last to consider and report what annual grants for the maintenance of Higher Agricultural (excluding Veterinary) Education should be made to Institutions providing such education in England and Wales, for the five academic years beginning on October 1, 1930.

Owing to pressure of Parliamentary duties, Sir Douglas Newton, K.B.E., M.P., has resigned his membership of the Committee, and Captain R. R. Henderson, M.P., has been appointed to succeed him.

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Young Farmers' Clubs International Cow Judging Competition, 1930.

THE ninth International Dairy Cow Judging Competition for Young Farmers' Clubs took place at the Royal Agricultural Show, Manchester, on July 9, by courtesy of the Royal Agricultural Society of England. Teams, champions, by eliminating contests, of America, Canada and England, respectively, competed for possession for the ensuing year of the *Daily Mail* Gold Challenge Cup. This was the first occasion on which a team representing Canadian Young Farmers had entered the competition. Of the previous eight contests, America has won 5 and England 3, the former country being the defenders of the trophy on this occasion. The contestants were required to place in order of merit rings, each of four cows, of the Friesian, Guernsey and Shorthorn breeds, and to give oral reasons in support of their judgment.

The judges were Mr. John Evens and Captain Alan Skelton, and the Umpire was Professor J. A. Scott Watson, M.A.

The contest proved to be the best ever held in the series, the teams reaching a uniform high level of excellence, as the judges noted in their subsequent remarks. A large crowd witnessed the proceedings and followed the oral reasons of the competitors with keen and appreciative interest.

The English team, which consisted of two girls and one boy, and which was led and trained by Mr. J. C. W. Simms, Assistant Agricultural Organizer for West Sussex, succeeded in regaining the trophy by the narrow margin of 16 points over the American team, Canada taking third place 35 points behind the American team. The scores were :—

England	766 points.
America	750 ,,
Canada	715 ,,

The scores of the individual competitors were :—

Competitor	*Age*	*Country*	*Points*
(1) Arthur Culley ..	16	England (Bucks) ..	266
(2) Felix King ..	16	America (Oklahoma) ..	257
(2) Josephine Armstrong ..	18	England (Northumberland)	257
(4) Halley Kennedy ..	20	America (Oklahoma) ..	256
(5) Cedric Kirkpatrick ..	19	Canada (New Brunswick)	246
(6) Clifford Baldwick ..	16	Canada (Ontario) ..	244
(7) Elsie Tidy ..	17	England (East Sussex) .	243
(8) James Childers ..	19	America (Oklahoma) ..	237
(9) Gordon Campbell ..	13	Canada (Nova Scotia) ..	225

In addition to the Cup, Silver and Bronze Medals were awarded by the *Daily Mail* to the members of the teams taking first and second place, respectively. A Certificate of Merit was also awarded to each competitor by the Royal Agricultural Society of England. The awards were presented by H.R.H. the Duke of Gloucester, the President of the Society.

In connexion with the above-mentioned contest, it is of interest to note that a letter, signed by H.R.H. the Duke of Gloucester, the President of the Board of Education, the Minister of Agriculture, the President of the National Farmers' Union, and the President of the National Council of Social Service, appeared in *The Times* of July 7, calling general attention to the activities of the Young Farmers' Clubs Movement and appealing for the assistance of more men and women in the villages who will take the initiative in forming clubs, and will act as club leaders or as members of the Advisory Committees which are an essential part of every club.

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"DRY PICKLING" OR "DUSTING" SEED WHEAT TO PREVENT BUNT:

RESULTS OF CO-OPERATIVE TRIALS BY ADVISORY MYCOLOGISTS IN ENGLAND AND WALES, 1927-28

Summarized by GEO. H. PETHYBRIDGE, Ph.D., and W. C. MOORE, M.A.,

Ministry of Agriculture Plant Pathological Laboratory, Harpenden.

BUNT or Stinking Smut is a fungus disease of wheat in which the ears produce "butts" or "bunts," *i.e.*, deformed grains containing a black, fishy-smelling, greasy at first but ultimately powdery substance consisting of myriads of spores, instead of normal grains with germ and food-store.[1] The disease in this country arises almost entirely, if not wholly, from the sowing of seed grain that carries these spores adhering to its surface. It can readily be prevented by suitable disinfection of such externally contaminated seed.

The disinfecting process is commonly called "pickling," and the standard disinfectants in use are : (1) a solution of copper sulphate (bluestone) and (2) a solution of formaldehyde gas in water generally known as formalin. Although treatment of contaminated seed grain, when properly carried out with either of these solutions, has been proved over and over again to give satisfactory results in suppressing Bunt, yet the method has certain disadvantages. Wetting the grain and drying it again afterwards is troublesome ; injury to the vitality of the grain may occur if the solution is too strong, or if the grain is already damaged mechanically or otherwise ; further, re-contamination after pickling has to be guarded against, particularly after formalin treatment. These are some of the drawbacks.

Probably these difficulties have sometimes been exaggerated, as far as this country is concerned, and there are still too many of our farmers who sow untreated, contaminated seed and get bunted crops. In other countries, as in the large wheat-producing areas in Australia, Canada and the U.S.A., where the prevailing condition of the seed grain involves greater risk of injury from a wet treatment, these difficulties are more real. Other methods, therefore, have been sought, and one now employed to a very considerable extent consists in dressing

[1] A full description of the disease and of methods for controlling it will be found in Leaflet No. 92 (*Bunt and Smut in Wheat*), obtainable from the Ministry at 10 Whitehall Place, London, S.W. 1.

the seed with a very finely divided fungicidal powder or dust. This means that a dry method of treatment is now employed instead of a wet one.

The advantages of a dry over a wet treatment are fairly obvious and need not therefore be discussed in detail here, although it may be mentioned that the two most important ones are (1) that the dry treatment does not injure the vitality of the grain and (2) that treated grain need not be sown immediately. It must not be assumed too readily, however, that a dry "dusting" process has no drawbacks. A machine of some kind is necessary for the efficient treatment of any considerable quantity of seed. A home-made one may be constructed from a barrel or suitable box mounted so that it can be rotated like a churn, and it should be provided with internal longitudinal baffle plates or some other device to ensure that seed and powder become intimately mixed during rotation. Making the machine absolutely dust-proof may present some difficulty, but this is particularly important, because inhalation of the powder by the operator may have very serious consequences.[2]

Masks should certainly be worn if dust-proof conditions cannot be secured. Other important points to be considered are the relative fungicidal efficiency of a dry treatment as compared with a wet one, and the relative costs of the two methods.

It cannot be expected that the solid particles of a powder, however small they may be, will reach every cranny, crevice or crack in the surface of a wheat grain in the same way as a liquid can do. Nevertheless, since the Bunt spores themselves are naturally dusted on to the grain it should also be possible to apply particles of a fungicidal powder to an equal or even greater degree. As a matter of fact, the individual particles of a suitably prepared powder are much smaller than Bunt spores, so that, provided the particles themselves do not become aggregated into clumps, it is possible, by thorough mixing of seed and powder, to ensure that every spore is in contact with some of the powder.[3] There will not,

[2] The powders used are in an extremely fine state of division. Even copper carbonate is not harmless, while some of the proprietary powders or dusts on the market contain mercury or arsenic compounds which render them extremely dangerous.

[3] If, however, contamination with Bunt spores were so heavy that they formed a continuous layer or coating over the grain, then the addition of a powder might merely form a second layer over the first one, and some of the spores nearest the surface of the grain might not come into contact with particles of the powder.

however, be any immediate fungicidal action as occurs when a spore becomes wetted by and absorbs a fungicidal solution. The powders used are, for the most part, insoluble in water. When the dusted grain is sown and absorbs moisture from the soil, the environmental conditions may conceivably be such that traces of the powder slowly become dissolved, and that the spore is killed by absorbing them. It is more likely, however, that the spore itself lies unaffected until it germinates. It is probable that its delicate germ tube, with the aid of something that it excretes, then actually dissolves some of the powder, absorbs it and becomes poisoned. From this it will be clear that some re-contamination of the seed after dressing with a powder can be of no material consequence. The act of powdering and the process of disinfection are not simultaneous; and any extra spores that may reach the grain after powdering will be subject to the same eventual fungicidal conditions as are those spores that were already on the grain before powdering.

History of Dry Pickling.—A word or two on the history of dry pickling may be added.[4] The idea is not new, nor is it very far fetched. In Germany, von Tubeuf tried what he called "candying" the grain with various substances as long ago as 1902; and, with a precipitated copper carbonate powder, he obtained promising results. This appears to have been the starting point, but this worker did not pursue the matter further. Jordi, in Switzerland in 1908–9, tried a mixture of powdered copper sulphate and sugar (both soluble substances), but without satisfactory results.[5] It is to the phytopathologists of Australia that credit must be given for the practical introduction of dry pickling of wheat against Bunt. M. H. Reynolds,[6] in New South Wales, used copper carbonate powder in 1912 for the first time, and found it very efficacious. G. P. Darnell-Smith[7] was mainly responsible for extending the use of this powder in Australia during the succeeding decade, and it is now commonly used there. Dry pickling of wheat has also made considerable headway in North America where copper carbonate has been employed

[4] A good account of this was given by E. Molz in the *Deutsche Landwirtschaftliche Presse*, 54, 1927, p. 520.

[5] *Jahresber.* d. landw. Schule Rütti-Bern: 1908–9, p. 89.

[6] *Agricultural Gazette* of New South Wales, 24, 1913, p. 461.

[7] *Ibid.* 26, 1915, p. 242; 28, 1917, p. 185; 30, 1919, p. 685; 32, 1921, p. 796; and 33, 1922, p. 754.

largely, although other materials, especially those of a proprietary nature, are also on the market there. In France and in Germany, on the other hand, the earlier results with copper carbonate were not very satisfactory, and in the latter country, particularly, chemical manufacturers have introduced other powders, many of which contain one or other compound of mercury, and some contain arsenic, both substances being highly poisonous. At the present time the variety of foreign proprietary powders is almost bewildering, and new names are constantly being added to the list.

In England and Wales, Miss Sampson reported the results of trials with copper carbonate powder in 1923[8] and, in collaboration with D. W. Davies,[9] published further results in 1926. They showed that Bunt could be controlled, but not completely eliminated, by the application of copper dusts. Dillon Weston[10] made trials with copper carbonate dust in comparison with formalin and copper sulphate solution during the seasons 1924–26. The seed used was very heavily artificially contaminated with Bunt spores and was such as no farmer would normally sow. The non-pickled seed gave 87 and 90 per cent. of bunted ears; copper carbonate, at 3 oz. per bushel, reduced these figures to 15 and 10 per cent., whilst copper sulphate solution gave 6 and 2 per cent., and formalin 0·3 and 0·0 per cent. respectively. In further trials it was shown that the efficacy of copper carbonate dust was proportional to the rate of contamination of the seed grain. Thus, with 4 per cent. of butts (by weight) incorporated with the seed, copper carbonate at 3 oz. per bushel reduced the resulting bunted ears from 94 to 11 per cent. With 0·2 per cent. of butts, it was reduced from 25 to 1 per cent. It was also shown that the percentage of bunted ears was reduced by increasing the amount of copper carbonate used to treat the grain. At 3 oz. per bushel, Bunt was reduced from 86 to 24 per cent.; at 6 oz. to 14 per cent. and at 9 oz. to 6 per cent.

Woodward[11] carried out experiments in the same years with results showing that treatment with 2 oz. of copper carbonate per bushel was practically as good as the wet treatment with formalin or copper sulphate.

[8] Welsh Plant Breeding Station, Series C, No. 3, 1921–22, 1923, p. 46.

[9] *Welsh Jour. Agric.*, 2, 1926, p. 188.

[10] *Annals of Applied Biology*, 16, 1929, p. 86.

[11] Nat. Farmers' Union *Year Book*, 1927; and the *Farmer & Stock-Breeder*, Jan. 2, 1928.

Buddin[12] carried out Bunt prevention trials over the three years 1924–26. Copper carbonate dust, at the rate of 3 oz. per bushel, was found to be effective in cases of moderate seed contamination, but was less effective than copper sulphate solution where the seed was heavily contaminated.

Official Experiments. — At the Ministry's Plant Pathological Laboratory, dry pickling experiments with barley for Covered Smut were started in 1923. They were extended to Bunt in wheat, and the trials with copper carbonate were encouraging. At the Conference of Advisers in Mycology from the fourteen provinces of England and Wales, held in December, 1925, it was decided to carry out a series of co-operative trials in order to obtain further data as to the relative efficiency of dry copper carbonate treatment for Bunt control as compared with that of the older standard wet treatments. This series was successfully carried out in 1926–27 in thirteen counties, and it was repeated in twelve counties in the following year. The counties ranged from Northumberland to Devon and from Essex to Cardiganshire, and thus a variety of soil and weather conditions was encountered. The following ten Advisers took part in the trials: Mr. A. Beaumont, Seale-Hayne College, Devonshire; Dr. F. T. Bennett, Armstrong College, Newcastle-upon-Tyne; Mr. W. Buddin, University of Reading; Mr. D. W. Davies, University College, Aberystwyth; Dr. R. M. Nattrass, Long Ashton Research Station, Bristol University (assisted by Mr. R. W. Marsh); Mr. N. C. Preston, Harper Adams Agricultural College, Newport, Salop; Mr. E. Holmes Smith, The University, Manchester; Dr. W. A. R. Dillon Weston, University of Cambridge; Dr. T. Whitehead, University College of North Wales, Bangor; and Dr. R. C. Woodward, University of Oxford. The Ministry's Plant Pathological Laboratory at Harpenden also collaborated.

The details were practically the same in each year and may briefly be mentioned. The seed used in all cases was from the same bulk, being from a pure line of "Little Joss." It was treated in October at one centre, viz., Cambridge, and the requisite quantities for the different plots were distributed to each Adviser. The seed was artificially contaminated with Bunt spores by rubbing it up with "butts" from an affected "Little Joss" crop of the previous season, care being taken to ensure that the whole bulk of seed became uniformly con-

[12] Univ. of Reading, *Guide to the University Farm and Expt. Station*, 1927, pp. 42–44.

taminated. That it was adequately contaminated for the purpose of the trials is shown by the fact that the average number of bunted ears yielded by it when untreated was just over 22 per cent. in the first year and just over 23 per cent. in the second year.

One part of the contaminated seed was not further treated and served for the "control" plots. A second part of the contaminated seed was pickled with a 2½ per cent. solution of copper sulphate by the sprinkling method, and a third part was treated with formalin (1 part in 320 parts of water) by the sprinkling and covering method, as described in the Ministry's Leaflet No. 92. The fourth part was treated with copper carbonate "dust" at the rate of 2 oz. per bushel, a machine constructed for such treatment being used to apply it.

Before sowing, samples of the grain, both untreated and treated, were tested for germination by the Official Seed Testing Station, Cambridge. In no case was the germination below 95 per cent. Further germination tests were carried out at monthly intervals, but even at the end of five months the germination had in no case fallen below 93 per cent.

The lots of seed were despatched to each Adviser on the same day, viz., that following treatment, and it was sown as soon after receipt as local conditions permitted. In some cases, owing to unforeseen difficulties, the seed either could not be sown until the spring, or the plots had to be re-sown then. The results of such plots are not incorporated in the table which follows, but it may be stated here that they did not differ essentially from the results of the autumn-sown plots. The degree of Bunt attack in the spring-sown plots, however, was considerably less than that in those sown in the autumn, an experience which commonly holds good.

Each trial consisted of four plots sown with the contaminated seed (1) not further treated (control), (2) treated with copper sulphate solution, (3) treated with formalin solution, and (4) "dusted" with copper carbonate powder, respectively. Each plot consisted of 200 ft. of drill, arranged where possible in eight parallel drills each 25 ft. long. Some of the Advisers found it possible to duplicate or triplicate their trials. At harvest all the ears from each plot were examined individually for the presence or absence of bunted grains, any ear that contained one or more "butts" being regarded as bunted. In one or two instances it was not found feasible to examine the whole of the produce of each plot, but in such cases a representative portion was examined. The number of ears per plot

TABLE I.—PREVENTION OF BUNT, 1927 AND 1928 TRIALS

Name of Adviser and County	No. of Trial		Percentage Bunted, 1927				Percentage Bunted, 1928			
	1927	1928	"Control" untreated	Formalin	Copper sulphate solution	Copper carbonate dust	"Control" untreated	Formalin	Copper sulphate solution	Copper carbonate dust
Beaumont (Devon) ..	1	1	1·90	0·00	0·15	0·15	6·45	0·03	0·00	0·00
,, ..	2	—	5·00	0·00	0·15	0·03	—	—	—	—
,, ..	3	—	4·50	0·00	0·09	0·05	—	—	—	—
Bennett (Northumberland and Durham) ..	1	1	14·95	0·00	0·00	0·80	24·15	0·02	0·04	0·69
,, ..	—	2	—	—	—	—	24·83	0·06	0·04	0·94
,, ..	—	3	—	—	—	—	17·06	0·38	0·08	1·15
,, ..	—	4	—	—	—	—	23·65	0·13	0·26	1·56
Buddin (Berks)	1	1	14·65	0·03	0·27	0·23	8·60	0·09	0·13	0·05
Davies (Cardigan and Merioneth) ..	1	1	16·00	0·32	0·20	0·06	7·74	0·03	0·00	0·00
,, ..	2	—	16·50	0·00	0·07	0·17	—	—	—	—
,, ..	3	—	7·60	0·00	0·00	0·18	—	—	—	—
Nattrass and Marsh (Wilts. and Somerset) ..	1	1	18·11	0·00	0·19	0·42	27·01	6·91	0·03	0·10
,, ..	2	2	10·00	0·00	0·00	0·90	23·65	0·15	0·00	0·00
,, ..	3	—	17·00	0·76	0·15	0·73	—	—	—	—
Preston (Salop and Staffs) ..	1	1	11·00	0·00	0·50	1·00	21·44	0·16	0·32	1·33
,, ..	2	—	12·20	0·00	0·00	0·40	—	—	—	—
Holmes Smith (Cheshire) ..	1	1	23·91	0·04	0·18	0·41	47·51	0·26	1·47	1·33
Dillon Weston (Cambridge and Essex) ..	1	1	47·09	8·59	1·06	6·00	26·82	0·50	0·13	0·13
,, ..	2	2	52·31	2·21	0·98	2·18	30·16	0·38	0·04	0·57
,, ..	3	3	73·09	3·55	3·02	6·33	35·34	0·86	0·11	0·15
Whitehead (Denbigh) ..	1	—	8·23	0·08	0·06	0·62	—	—	—	—
Woodward (Northants) ..	1	1	34·42	0·19	0·10	0·29	15·66	0·00	0·00	0·00
,, ..	—	2	—	—	—	—	24·67	0·00	1·18	0·00
Path. Lab. (Herts) ..	1	1	20·91	0·03	0·37	0·61	27·33	—	0·00	—
Average per cent. bunted			22·44	0·92	0·40	1·19	23·20	0·68	0·16	0·38

examined in 1927 averaged over 2,500, and in 1928 over 3,000, so that an adequate number was taken from which to determine the percentage of bunted ears present. The results are presented in Table I (*see* p. 435).

This table indicates that Bunt attack on the crop from the untreated grain varied very considerably from place to place according to local conditions. In 1927, it varied between 1·9 per cent. (in Devonshire) and 73·09 per cent. (in Cambridgeshire), and in 1928 between 6·45 per cent. (in Devonshire) and 47·51 per cent. (in Cheshire). The average percentage of attack in the 20 trials in 1927 and the 17 trials in 1928 was 22·44 and 23·20 per cent., respectively. Bunt was very successfully suppressed by the formalin treatment in both years, although the Cambridge trials (Dillon Weston) in 1927 and one of the trials in Somerset in 1928 (Nattrass & Marsh) were exceptions. Successful results were also obtained in both years with copper sulphate solution and with copper carbonate dust, although it would appear that the dust treatment was slightly less effective in 1927 than the wet treatments.

Taking the mean of the results of the two years' trials the following figures are obtained :—

Treatment	*Percentage Bunted*
Copper sulphate solution	0·28
Formalin	0·79
Copper carbonate (dust)	0·80
Untreated	22·82

It is clear from these figures that all three methods of treatment were very efficacious in controlling Bunt, and, taking experimental error into account, it is probable that the differences in the percentage figures found for the treated seed are not highly significant, although copper sulphate solution appears to have given slightly better results than the two other fungicides. From the practical standpoint it seems justifiable to conclude that in controlling Bunt dry pickling with copper carbonate is just as efficacious as wet pickling.

Effect on Yield.—To a farmer, of course, mere suppression of disease in a crop by fungicidal or other treatment is not enough, because a remedy may be worse than the disease it obviates, if the result is obtained at the cost of serious diminution in yield. This point, indeed, is sometimes urged against wet pickling of wheat with copper sulphate or formalin; for although there may be no Bunt in the resulting crop, yet, owing to damage to the vitality of the seed, the yield may be so reduced that the crop is unprofitable. Yield, therefore, is

equally as important as disease prevention, if not, indeed, more so.

For various reasons, no attempt was made in the trials now under discussion to arrange for accurate quantitative determinations of the amount of grain yielded by the various plots. Nevertheless, some idea of the productive capacity of the untreated grain and of that treated with the three fungicides used can be obtained by comparing the average number of ears produced per plot. It has already been stated that, with few exceptions, the percentages of bunted ears were determined by counting and examining all the ears from each plot. Omitting the exceptional cases, then, the total number of ears per plot per treatment has been averaged for 18 trials in 1927 and for 13 in 1928, with the results shown in Table II.

TABLE II

Seed Treatment	Average number of ears per plot	
	1927	1928
Untreated	2,919	3,291
Formaldehyde solution ..	2,559	3,412
Copper sulphate solution ..	2,520	3,189
Copper carbonate dust ..	3,057	3,549

From the figures in Table II, it will be seen that in both years the plots sown with contaminated seed treated with copper carbonate dust gave the largest average number of ears. Further, the plots sown with contaminated seed treated with copper sulphate solution gave in both years the smallest average number of ears. Assuming that the yield of grain varies in the same sense as the number of ears, which does not seem to be unreasonable, it would follow that the best average yield followed copper carbonate dust treatment of the seed. It seems likely that this slight superiority in yield resulting from copper carbonate dust treatment would compensate for any slight deficiency in fungicidal effectiveness as compared with the two wet treatments. In view of unavoidable experimental error, however, too much stress must not be laid on the actual figures in the above table. What appears to be clear is that in neither year is there anything to indicate that the result of copper carbonate dust treatment, in respect of number of ears produced, is inferior to that of the two wet treatments or of no treatment at all.

Summing up, therefore, it may fairly be said that the trials carried out show that the dry method of pickling seed wheat with copper carbonate dust for preventing Bunt compares at least very favourably with the older wet methods of pickling

with copper sulphate and formalin, both in respect of fungicidal efficiency and crop yield; and the method is certainly worthy of more extended trial by farmers themselves.

Cost.—As to the relative costs of the three methods of treatment it must be confessed that the dry treatment with copper carbonate comes out a little higher than that of the two others. Thus, Dillon Weston[13] has calculated that the relative costs of the three treatments (including materials and labour, but not allowing for depreciation on the machine) per acre sown are: formalin 3d., copper sulphate solution 4d., copper carbonate dust 8d. In most cases, *provided a machine is available*, the greater convenience of the dusting method would probably compensate for the slightly increased cost of the dry treatment.

Copper carbonate powder, specially prepared for use in Bunt prevention, is made in England by more than one firm of chemical manufacturers, and is exported in large quantities to Australia and elsewhere for this purpose. The demand for home use has not yet become so great as to make the powder so readily obtainable locally by farmers as is copper sulphate, but there should be no real difficulty in obtaining it. In quantities less than 1 cwt. it should cost about 1s. 3d. per lb., while in larger quantities the price should be about 1s. per lb. In some districts the prices may be higher than these.[14]

Conclusion.—Farmers are naturally and rightly conservative in their methods. The cautionary couplet—

> "Be not the first by whom the new are tried
> Nor yet the last to lay the old aside"

may well be their motto. Bunt is far too prevalent in our wheat fields, and its elimination, or at least its reduction to a minimum, is by no means a difficult or costly matter. Those who have hitherto refrained from pickling their seed for fear of injuring the vitality of the grain, and thus getting a poor stand, may confidently try the newly-introduced dry method of treatment; whilst those who have in the past regularly adopted one of the wet methods might well try the dry one to

[13] *loc. cit.*, p. 90.

[14] Copper carbonate, $CuCO_3$, as a normal salt, has never been prepared by chemists, but there are several basic salts. For Bunt prevention, the relatively pure basic carbonate used in chemical laboratories and costing 3s. or more per lb. is not required.

ascertain whether it is perhaps not more advantageous, on the whole, than the old wet ones.

Note.—Assistance or advice as to the construction of a suitable machine or as to any other point concerning Bunt prevention, if required, should be sought from the Adviser in Mycology at the Agricultural Advisory Centre in the province in which the farmer resides. A list of Provincial Advisory Centres is given in Leaflet No. 279 (*Technical Advice for Farmers*), which may be obtained free of cost and post free from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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NEW METHODS OF TESTING FERTILIZER DISTRIBUTORS:

WITH SUMMARY OF A TRIAL AT JEALOTT'S HILL, APRIL, 1930

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THE importance of the accurate distribution of fertilizers on the land has become increasingly evident during the last few years, both to farmers and to the manufacturers of agricultural machinery.

Scientific research has shown the importance of supplying a properly balanced mixture of plant food to the growing crop, and the general spread of knowledge regarding the essential plant foods has enabled manufacturers and mixers gradually to increase the concentration of fertilizers, thus rendering their correct distribution a matter of considerable importance.

New methods of manufacture have advanced this procedure a stage further. Concentrated complete fertilizers are now being made in England of approximately double the strength of those more commonly sold, *i.e.*, in place of a fertilizer containing, for example, 5 per cent. of nitrogen, 10 per cent. of phosphoric acid and 5 per cent. of potash, it will be possible to obtain one containing 10 per cent. of nitrogen, 20 per cent. of phosphoric acid and 10 per cent. of potash. This will mean that instead of using, say, 8 cwt. per acre for sugar beet or potatoes, only 4 cwt. will need to be used, with a consequent saving in railway freight, carting from the station, and handling and distribution on the farm. Such an improvement effects large economies in transport and is certain in time to revolutionize farm practice with regard to mixed fertilizers.

It is clear, however, that the more concentrated a fertilizer is, the more necessary does it become that it should be evenly distributed over the land, and that the rate of distribution should be accurate. It is essential, moreover, that for crops requiring only a comparatively small dressing of fertilizer, a machine should be available capable of fulfilling the requirements even when only 1 cwt. or less per acre is being applied.

Yet another fact points to the importance of accuracy of distribution. Research has indicated that there is only a comparatively small lateral movement of fertilizers dissolved in the soil solution. Vertical movement of plant foods may occur under the influence of capillary rise and fall of soil water, particularly in the case of nitrogen, but lateral movement of phosphoric acid, potash and even nitrogen is only a matter of a few inches. This may often be seen in plot experiments in the field, where the edges of the plots under different treatments are usually very sharply defined.

With all these considerations in view, therefore, it is abundantly clear that the accuracy of fertilizer distributors, both as regards evenness of distribution and rate of distribution per acre, is a matter of direct practical and economic importance to the farmer. It was therefore decided that a full investigation of the position should be begun by the research staff of the company with which the writer is associated.

A survey of the work already done indicated the necessity for the elaboration of an entirely new technique. Many reports have been issued in America, Germany, Holland, France and Poland, and certain trials have been recently carried out in this country. It is, however, clear that critical work on a scientific basis has generally been carried out under conditions that are too artificial to provide results of real practical value. For example, in many experiments the machines were either jacked up from the ground and the wheels revolved, or they were drawn along over smooth board surfaces, usually by hand. Thus, the results, whilst giving a great deal of critical evidence on the capabilities of the machines when used under ideal conditions, and much information regarding the sowing properties of fertilizers as influenced by conditions of temperature and humidity, gave very little sure evidence of the performance of either machines or fertilizers under the actual conditions that prevail on the farm. New methods had, therefore, to be designed to imitate practical conditions as far as possible, and it was resolved to

hold a trial, open to all manufacturers who cared to enter their machines, in order to test the efficacy both of the methods of trial evolved and of the machines entered.

It is characteristic of the present desire for progress and improvement that no fewer than 11 manufacturers entered machines in these trials. Every one of them showed a keen interest in the methods adopted, and a desire to use the information which might result for the improvement of the machines which they are offering to the farmer. The comparatively poor performance of some of the machines when accurately tested on specific points, such as evenness and rate of application per acre, was clearly as great a surprise to the makers as to the judges. I should like, therefore, to put on record an appreciation of the public-spirited attitude of all those makers who submitted their machines to these accurate tests. The manufacturers of the machines that were the least successful are far more to be congratulated than those who did not send their machines, since their willingness to compete in the trial indicated their desire to learn more about the machines which they were offering to the public, and if possible to improve them.

There is a large field open for investigation. It is obviously desirable that machines should be tested (1) with at least three different amounts of fertilizers in the hopper, *i.e.*, full, half-full and nearly empty; (2) with a large variety of fertilizers; and (3) with fertilizers varying in physical condition. The accuracy of the proposed tests, however, was such that a considerable time would be required for each individual test, and it was necessary to simplify the issue as much as possible. The trial was, therefore, concentrated on obtaining data relating to the sowing of four fertilizers, all in good mechanical condition, under conditions as nearly as possible comparable with those of ordinary farm practice. The four fertilizers selected were :—

(*a*) North African phosphate.
(*b*) A complete mixed fertilizer, ordinary grade.
(*c*) One of the new concentrated complete fertilizers.
(*d*) Sulphate of ammonia.

In Table I are given the various headings on which the machines were judged, together with the number of points allotted for each.

As the technique involved in obtaining accuracy of performance and of scoring in many of the above features is novel, it may be useful to give it here in some detail in the hope that it may be of assistance in the planning of further trials.

TABLE I

Features Judged	*Points Awarded*
(1) Evenness of distribution *along* the track of the machine	25
(2) Evenness of distribution *across* the track of the machine	25
(3) Material, durability and workmanship	10
(4) Ease of dismantling and cleaning	10
(5) Price	10
(6) Accuracy of calibration of sowing scale	10
(7) Ease of adjustment	5
(8) Lightness of draft and ease of manœuvring ..	5
Total	100
(9) Any special feature .. .. .. Bonus points	10

Technique.—The experimental field was marked out prior to the trials as indicated on the accompanying diagram, Fig. 1.

Each machine was drawn by means of a special bogie constructed to enable the distributors to be drawn along without interfering with any apparatus placed in the centre of Course 1 (Figs. 2 and 3). The bogie consisted of a pair of wheels with a 12-ft. axle, above which is mounted a pair of shafts, approximately 11 ft. apart. These are provided with special irons for the horses' neck leathers and for traces, and are attached at the back to a framework mounted above the 12-ft. axle. In the centre of this framework, and mounted vertically at the back of it, is a special iron bracket having a series of holes at distances of from 2 to 4 ft. above the level of the ground. The method of attachment of the fertilizer distributors to this bracket varied according as the distributor had shafts or a centre draw-pole. In the latter case a small shackle was slipped through the ring at the point of the distributor pole and attached to the special vertical draw-plate on the bogie by means of a pin and cotter-pin. When the machine was fitted with shafts a special swingle-tree was first clamped by large U-bolts to the fore ends of the shafts and attachment was made to the special bracket on the bogie by means of a pair of shackles attached to the bogie and a pin through a hole in the centre of the swingle-tree respectively.

In the first test each machine was filled with fertilizer A at Dump D and, drawn by two horses on the special bogie, proceeded to the prepared course of 100 yd. This course was marked out 12 ft. wide, the width of the bogie, and in the centre of the track at the 10, 20, 30, 40, 60, 70, 80, and 90 yd. marks were placed trays having an area of 2 sq. yd. The trays used were of wood with sides having very sharp edges so that the total area on to which fertilizer was to fall was exactly 2 sq. yd. bounded by the equivalent of a knife edge. These trays were placed transversely across the track about its centre line. There was a small varying margin (according to width of machine) at each side of the tray untested, so that the test was based on the central six feet.

After each run with each of the fertilizers a squad of assistants emptied the fertilizer dropped into the trays into special envelopes preparatory to weighing. Weighing the amount of fertilizer

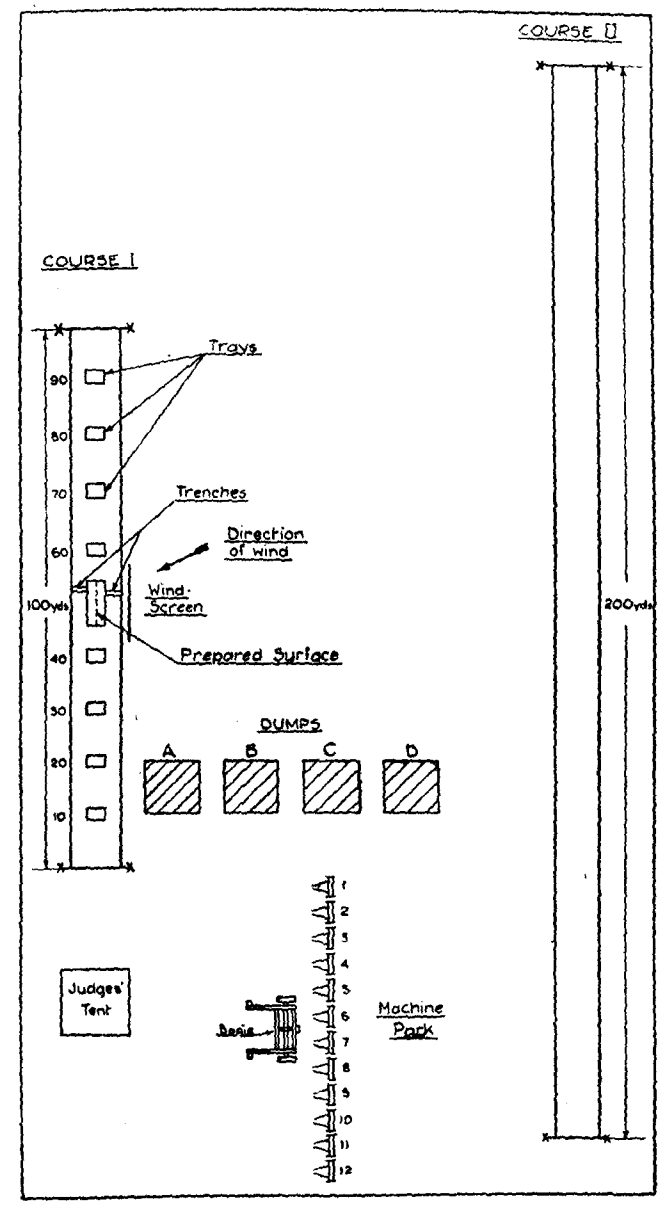

FIG. 1.—Arrangement of the experimental field.

in each envelope was carried out to the nearest gramme. Theoretically the envelopes in each of the series A, B, C and D should have contained 126, 63, 42, 21 gm. corresponding to 6, 3, 2 and 1 cwt. per acre respectively.

In the middle of the 100-yd. course was placed a low wooden platform, about 1½ in. above the ground level, with an area of 6 × 12 ft., the 12 ft. length being in the direction of progress of the machines. In tests with fertilizers A, B and C this prepared area was covered with a black surfaced paper, and three independent judges awarded points for evenness of distribution of fertilizer across the area. With fertilizer D a framework covered with similar black paper was superimposed upon the low platform, and the surface treated with a quick-drying varnish. Thus, as each machine crossed this area, a permanent record of its performance was obtained. Photographs of some of these records are reproduced in Figs 4, 5 and 6.

In addition, two small trenches were cut, one on either side of the platform, to a depth of about 3 in. and a width of 1 ft., in order to test the effect of bumps upon the working of the machines. The two trenches were not cut exactly opposite each other, so that in the actual run the machines were jerked first to one side and then to the other.

After these tests had been carried out with each machine on each of the four fertilizers, the special bogie was detached and the machine proceeded with a single horse to the second course. Here, a tarpaulin was tied in front of the hopper of each machine, carried beneath the hopper and fixed clear of the gears at either end. Each manufacturer's representative was then asked to set the machine to sow 1 cwt. per acre of the fertilizer D and the machine proceeded along the 200 yd. course sowing fertilizer into the tarpaulin. At the exact end of the course the whole of the fertilizer sown was emptied from the tarpaulin and weighed. The machine was then turned round, the tarpaulin again attached and the machine set to sow 2 cwt. per acre. At the end of the run the total quantity of fertilizer sown was weighed as before. The machine then returned to fertilizer dump D, emptied out the remaining fertilizer and proceeded to the machine park.

In addition to the above tests, detailed examinations of the machines were made, and points awarded for materials, durability and workmanship, ease of dismantling and cleaning, and ease of adjustment. These features were judged by three independent engineers and the final marks awarded were the average of the three sets of figures. Points on materials, durability and workmanship were awarded from a consideration of the machines whilst standing in the machine park, whereas points on dismantling, cleaning and adjustment were judged while the machines were in operation on the two courses, but chiefly while they were being filled, emptied and adjusted at the various fertilizer dumps. Five points were awarded for lightness of draft and ease of manœuvring, the judging being carried out by the officer who had charge of the collection of the machines from the railway station, their manipulation on the field and their return to the railway.

Points awarded for the trials and the above considerations total 100, but to provide for any feature of the machine not catered for under headings already mentioned, or for additional points for exceptional merit, the score-card allowed of 10 bonus points available for award. At the conclusion of the trials all the judges

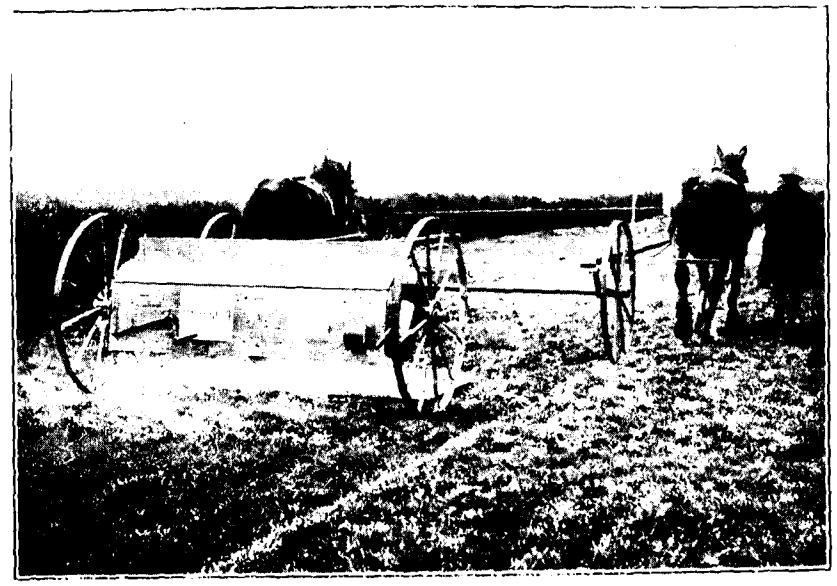

Photo: "Farmer & Stockbreeder."

FIG. 2. Showing Machine No. 4 being drawn by means of special bogie over the tray on Course 1.

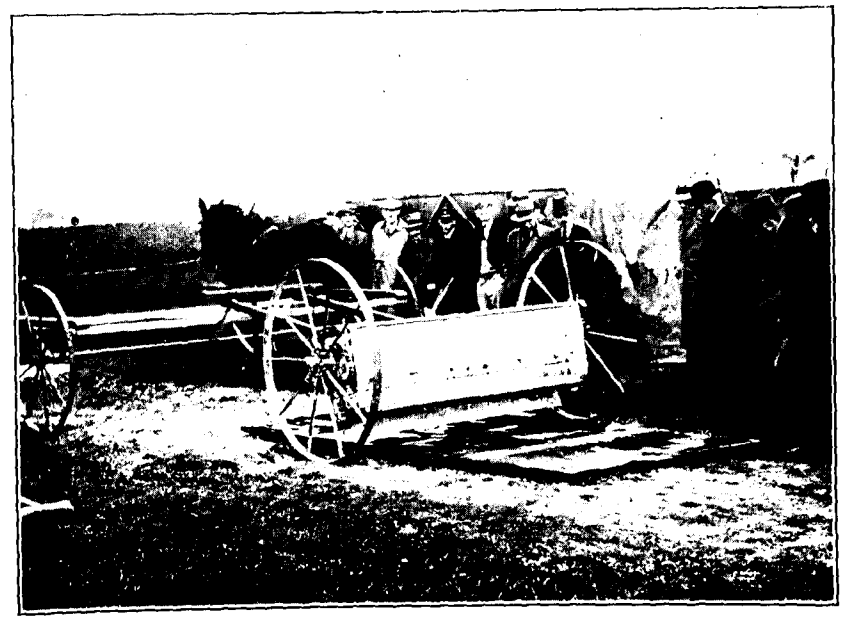

Photo: "Farmer & Stockbreeder."

FIG. 3. Showing Machine No. 11 being drawn by means of special bogie over the tray on Course 1.

NEW METHODS OF TESTING FERTILIZER DISTRIBUTORS.

To face page 444.

FIG. 6. Showing distribution of sulphate of ammonia on sticky paper. An enlarged view from sheet 6.

reviewed the machines in the field and discussed each machine (*a*) on the engineering side, and (*b*) on the agricultural side. For example, machines in which a serious attempt had been made to eliminate corrosion of working parts, other than by special paints, which are considered of doubtful efficiency, received 2 bonus points. Machines with extra large wheels, making for ease of draft and less jolting over rough ground, received from 1 to 3 bonus points, and so on.

Evenness of Distribution along the Track of the Machine.—As already explained, in this test each machine was drawn along a track 100 yards long, trays being placed at intervals to collect the fertilizer. The total number of points awarded under this test was 25, and Table II shows how the machines varied as regard this feature. The number of each machine indicates its position in the final result of the comprehensive trial.

TABLE II

POINTS AWARDED FOR EVENNESS OF DISTRIBUTION ALONG THE TRACK OF THE MACHINE

(Heading 1 : Possible points 25)

Machine in final order of merit	Average weight of fertilizer per tray and measure of dispersion (V) about the average								Points awarded						Placing in this test
	A		B		C		D		A	B	C	D	(*a*)	Total	
	Wt.	V	Wt.	V	Wt.	V	Wt.	V							
	gm.	%	gm.	%	gm.	%	gm.	%							
Ideal	126	0	63	0	42	0	21	0	5	5	5	5	5	25	
1st	133	12	71	20	47	16	30	21	3	2	2	1	3	11	1st
2nd	92	21	54	11	42	17	32	51	1	3	2	0	2	8	6th
2nd	111	32	33	10	34	13	21	25	0	4	3	1	3	11	1st
4th	118	16	58	16	66	17	79	13	2	2	2	3	2	11	1st
5th	165	14	166	8	119	13	37	33	3	4	3	0	0	10	4th
6th	86	11	19	8	35	35	12	12	3	4	0	3	0	10	4th
7th	74	52	77	29	53	26	43	20	0	0	0	2	0	2	10th
8th	60	34	26	18	51	15	15	19	0	2	3	2	0	7	8th
9th	91	30	46	14	31	35	13	25	0	3	0	1	0	4	9th
10th	75	21	34	16	49	9	18	29	1	2	4	0	1	8	6th
11th	139	28	20	30	54	26	27	39	0	0	0	0	1	1	12th
12th	78	22	45	64	57	24	74	59	1	0	1	0	0	2	10th

(*a*) Additional points are given for nearness of average weights sown to the "ideal" weights.

The statistical method for the allocation of points to each machine for its capacity to sow the same amount of fertilizer in all the trays at the various rates was as follows :—

(1) For each fertilizer sown by each machine the standard deviation of the weights sown in the 8 trays was computed from the formula :—

$$\text{Standard Deviation } (\sigma) = \sqrt{\frac{\Sigma d^2}{n}}$$

Fig. 4. Showing pattern left by Machine No. 5 when distributing sulphate of ammonia over the sticky paper. Distribution good.

Fig. 5. Showing pattern left by Machine No. 9 when sowing sulphate of ammonia over the sticky paper. Distribution faulty.

in which Σd^2 represents the sum of the squares of the deviations of the actual tray weights from the average weight and n represents the number of weights (in this case 8).

(2) The standard deviation was divided by the arithmetic mean of the tray weights M, and multiplied by 100 to obtain a percentage measurement of dispersion in terms of the average. The resulting figure is known as the coefficient of variation and is represented by the following formula :—

$$\text{Coefficient of Variation (V)} = \frac{\sigma}{M} \times 100$$

The actual working of two examples may serve to make the process of calculation clear up to this point. The first example is for an ideal distribution with fertilizer A in which the same weight of fertilizer is sown in each tray ; the second is the actual distribution of fertilizer B by machine No. 8, which is chosen as being one of the best performances in the test, although it was not sowing at the correct rate per acre. In both cases the weights are taken to the nearest gramme.

Example I Ideal distribution				Example II Machine No. 8			
Fertilizer A				Fertilizer B			
Tray	Weight (gm.)	d	d^2	Tray	Weight (gm.)	d	d^2
1 ..	126	0	0	1 ..	21	+2	4
2 ..	126	0	0	2 ..	21	+2	4
3 ..	126	0	0	3 ..	17	−2	4
4 ..	126	0	0	4 ..	20	+1	1
5 ..	126	0	0	5 ..	17	−2	4
6 ..	126	0	0	6 ..	19	0	0
7 ..	126	0	0	7 ..	19	0	0
8 ..	126	0	0	8 ..	17	−2	4
Total	1,008	0	0	Total	151		21
Mean=M=126				Mean=M=19			
$\sigma = \sqrt{\frac{\Sigma d^2}{n}} = 0$				$\sigma = \sqrt{\frac{\Sigma d^2}{n}} = 1{\cdot}6$			
$V = \frac{\sigma}{M} \times 100 = 0$ per cent.				$V = \frac{\sigma}{M} \times 100 = 8$ per cent.			

It is clear that the lower the coefficient of variation the less is the deviation of tray weights about the average weight, and, therefore, the better the performance of the machine, whilst the higher the percentage figure the greater is the dispersion and the less satisfactory the performance.

Any scheme for the allocation of points on the basis of the percentage variation figures can be designed to suit the degree of accuracy aimed at and the number of points to be allocated. For the present test the following arbitrary scale has been adopted :—

Coefficient of variation	*Points awarded*
0– 5 per cent.	5
6–10 per cent.	4
11–15 per cent.	3
16–20 per cent.	2
21–25 per cent.	1
26 and over	0

Thus, in Example I, since the coefficient of variation is 0 per cent. the points awarded would be 5 out of 5. In Example II where this figure is 8 per cent., the machine would receive 4 points.

Evenness of Distribution Across the Track of the Machine.—This test was carried out at the same time as that under the previous heading, and on the whole rather more satisfactory results were shown, as is indicated by the following table, which gives the points awarded to the several machines out of a possible 25.

As part of this test, trenches were dug at one spot over which first one wheel and then the other wheel had to pass. This was done to imitate the effect of a clod or furrow upon the working of the machine. The fertilizer was deposited on black paper as already described. Points were awarded in this case on the basis of a visual inspection of the distribution immediately a machine had passed over the prepared surface, a subsequent inspection of the permanent record with fertilizer D, and a consideration of the standard attained by each machine with all four fertilizers.

Machine in final order of merit	*Points awarded*	*Placings in this test*
1st	21	1st
2nd	19	3rd
2nd	20	2nd
4th	11	8th
5th	17	4th
6th	12	7th
7th	13	6th
8th	8	11th
9th	15	5th
10th	9	10th
11th	11	8th
12th	6	12th

Figs. 4 and 5 illustrate the best and worst distributions. These are from actual photographs showing the fertilizer adhering to the sticky black paper, after falling from the machine.

Price.—In allocating points under this heading, it was taken as an axiom that, from the farmer's point of view, a machine should be as cheap as possible. Consequently points were

awarded for price irrespective of any other feature of the machines, *i.e.*, no account whatever was taken of material, etc., or of the capabilities of the machines, since all these features received adequate consideration under the other headings.

Since the most usual sowing width of the machines was 8 ft. the method adopted was to take the actual price of the machines as supplied by the manufacturer and calculate the equivalent price for an 8 ft. machine. The points were then given on the basis of the equivalent price.

Accuracy of Calibration of Sowing Scale.—In taking into account the desirability of having a machine which can be adjusted easily to sow a definite amount of fertilizer per acre, it was realized that it is impossible for a manufacturer to arrange a sowing scale accurately to suit every fertilizer. There is a considerable variation in the physical properties of different fertilizers and sometimes even of samples of the same fertilizer. Consequently, although manufacturers were asked to set their machines to sow fertilizer D in two trials over a course of 200 yd. at rates of 1 and 2 cwt. per acre respectively, most of the points awarded were given on the nearness with which the second application was double the first application rather than on the actual accuracy with which the two dressings approximated to 1 and 2 cwt. respectively. A few points, however, were awarded for accuracy in the latter feature.

Table III shows the actual results obtained at the trials and the number of points allocated to each machine, the maximum number of points being 10.

Engineering Design.—It is difficult to summarize criticism on this point, but it will be generally agreed that the following points are desirable :—

(1) A positive measuring device for the feed should be aimed at.
(2) Lightness combined with strength—hence metal construction for most parts, tubular shafts, etc.
(3) Discharge of fertilizer should be close to the ground. This can often be combined with low loading.
(4) Adjustment of feed should be as simple as possible—hence no change wheels. Variable eccentrics or link motions of simple design offer the best solution.
(5) Parts working in the fertilizer should be avoided as far as possible. It is thought that the use of non-corroding material in places might be justified. In only two of the machines submitted had any real attempt been made to overcome corrosion of parts working in the fertilizer.
(6) Attention should be paid to the lubrication of moving parts. Stauffer grease cups or grease gun nipples might be a justifiable addition.
(7) A good quality protective covering is certainly required where metal is largely used in the construction.

TABLE III

POINTS AWARDED FOR ACCURACY OF CALIBRATION OF SOWING SCALE

(Heading 6 : Possible points 10)

Machines in final order of merit	Sowing width	Equivalent weights fertilizer sown per acre when machine set at		Ratio b : a (a=1)	Points awarded	Placings in this test
		(a) 1 cwt./acre	(b) 2 cwt./acre			
	ft. in.	lb.	lb.			
1st ..	8 0	135	279	2·07	9	1st
2nd ..	8 0	142	248	1·74	6	2nd
2nd ..	7 3	273	260	0·95	0	—
4th ..	7 6	371	288	0·78	0	—
5th ..	7 0	182	328	1·80	6	2nd
6th ..	8 0	66	172	2·60	3	5th
7th ..	9 0	165	470	2·84	2	6th
8th ..	8 0	66	190	2·88	2	6th
9th ..	6 10	84	198	2·36	5	4th
10th ..	8 0	113	141	1·24	1	8th
11th ..	7 0	216	672	3·12	0	—
12th ..	7 0	138	117	0·85	0	—
Ideal ..		112	224	2·00	10	

It would probably be found impossible to incorporate all these features in any one machine, but it is believed that items 2, 3, 4, 6 and 7 are always possible, while the nature of material to be handled would be borne in mind when considering 1 and 5.

I must record here my appreciation of the work done by many members of the staff of the Agricultural Research Department of Imperial Chemical Industries, firstly, in regard to the care and originality displayed in working out an entirely new method of technique, and secondly in the detailed routine work necessary, both during the trials and in the preparation of the statistical data. A more detailed report will be issued elsewhere at an early date.

Finally, I would again express my appreciation of the action of the manufacturers of fertilizer distributors who submitted their machines to these very drastic and informative tests. It is to be hoped that work of a similar standard of accuracy will be continued by them and others on similar lines.

APPENDIX I
MARKS AWARDED UNDER EACH HEADING

Machines in final order of merit	Evenness of distribution along track of machine	Evenness of distribution across track of machine	Material, durability and workmanship	Ease of dismantling and cleaning	Price	Accuracy of calibration of sowing scale	Ease of adjustment	Lightness of draft and ease of manœuvring	Special features	Total
Possible points	25	25	10	10	10	10	5	5	10	100 plus 10 bonus
1st ..	11	21	9	6	8	9	5	4	6	79
2nd ..	8	19	8	6	4	6	3	3	5	62
2nd ..	11	20	6	7	10	0	2	4	2	62
4th ..	11	11	8	7	7	0	5	4	8	61
5th ..	10	17	5	6	5	6	3	4	1	57
6th ..	10	12	4	6	8	3	2	4	2	51
7th ..	2	13	7	6	8	2	3	5	3	49
8th ..	7	8	7	7	9	2	2	4	2	48
9th ..	4	15	5	8	0	5	1	4	3	45
10th ..	8	9	7	5	5	1	2	4	1	42
11th ..	1	11	8	6	8	0	1	4	1	40
12th ..	2	6	6	7	3	0	2	2	1	29

APPENDIX II
ORDER OF MACHINES UNDER EACH HEADING

Machines in final order of merit	Evenness of distribution along track of machine	Evenness of distribution across track of machine	Material, durability and workmanship	Ease of dismantling and cleaning	Price	Accuracy of calibration of sowing scale	Ease of adjustment	Lightness of draft and ease of manœuvring	Special features
1	1	1	1	6	3	1	1	2	2
2	6	3	2	6	10	2	3	11	3
2	1	2	8	2	1	9	6	2	6
4	1	8	2	2	7	9	1	2	1
5	4	4	10	6	8	2	3	2	9
6	4	7	12	6	3	5	6	2	6
7	10	6	5	6	3	6	3	1	4
8	8	11	5	2	2	6	6	2	6
9	9	5	10	1	12	4	11	2	4
10	6	10	5	12	8	8	6	2	9
11	12	8	2	6	3	9	11	2	9
12	10	12	8	2	11	9	6	12	9

IMMATURE *versus* MATURE SEED POTATOES

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THERE are many references in literature to the advantages obtained by the use of immature (*i.e.*, early-lifted) seed tubers. In 1916, for instance, Hutchinson[1] summarized, in this JOURNAL, the results of trials carried out over a number of years by the Agricultural Departments of Armstrong College, Leeds University, the Midland Agricultural College, the South-Eastern Agricultural College at Wye, and by Messrs. Sutton & Sons. He showed that, in every case, immature seed of all the varieties used gave a higher total crop and a larger proportion of saleable tubers than did mature seed. It was not until about 1921 that the importance of virus diseases in causing deterioration in the cropping power of potatoes became generally recognized in this country, so that it is not surprising to find Hutchinson overlooking the full significance of the relative abundance of "curled" plants arising from mature seed, as compared with those from immature seed, in his trials at Wye in 1913. He does, indeed, state that "the disease causing leaf curl can be largely checked by using immature seed," but does not include this amongst the possible causes of the superiority of immature seed.

Since that time, ample evidence has been accumulated, by several workers, to prove that immature tubers are relatively free from virus diseases. The writer, for example, found no evidence, in 1923, of tuber infection with Leaf-Roll occurring in tubers lifted up to July 28, whilst mature tubers lifted in December showed 48·1 per cent. of infection.[3] In the following year no infection was found in tubers lifted up to August 19, whereas the mature tubers lifted on November 3 showed 23·4 per cent. of Leaf-Roll.[3] There has also been recorded the continued freedom from virus diseases of an early variety, lifted in an immature condition each year (for a period of twenty-one years) in a sheltered garden where mature tubers invariably showed a large percentage infection.[4] This freedom from infection is due to the fact that most, if not all, virus infection enters the healthy plant through the foliage, and an appreciable time is required for the virus to reach the tubers; such tubers, therefore, as are lifted early are less likely to have contracted disease from the foliage than are those left until the tops have ripened off. The only conflicting evidence that the writer has

been able to discover is that of Profeit and Findlay,[2] wh found no difference in the amount of virus infection in immatur and mature seed. The explanation is, doubtless, that owing t the rarity or absence of transmission of these diseases a Aberdeen, where their work was carried out, they were dealin only with secondarily infected plants, the whole progeny o which would be infected from the "mother" tubers. Qualit in seed tubers has thus come to mean freedom from viru diseases, and in this sense there can be no doubt of th superiority of immature over fully ripened tubers.

There still remains the question whether immaturity, as suc is an advantage in selecting seed tubers. To ascertain whethe this is the case, the first essential is to eliminate the influenc of virus diseases, and the writer has therefore made use c stocks of two varieties as nearly free from these diseases a can be obtained in bulk. The stocks were Irish certified see and were planted on April 20, 1928, on an Anglesey farn where there was reason to believe that little or no transmissic of virus diseases occurs. Every plant was inspected sever times during the growing season by the writer's colleagu Mr. J. F. Currie, and each plant showing disease was at on removed. The total virus diseases found in the crops amounte to 0·11 per cent. in the variety Kerr's Pink and 0·22 per cent. i Great Scot. Immature seed from both varieties was lift on August 13, 1928, and fully ripened seed on October 12. Bo classes of seed were boxed under identical conditions an before planting, the tubers were carefully graded so th similar sets were used in all cases.

Planting was carried out on March 23, 1929, according the plan shown in the text figure, the trial being laid down what appeared to be fairly uniform land. Immature and matu seed of each variety were replicated eight times in alterna drills of 56 tubers each, the order being reversed in the seco set of four replications. The text figure gives the total crop pounds from each unit drill of 56 tubers, and shows that the was an evident improvement in fertility, along the drills, fro the southern half to the northern half of the trial, but appreciable drift in fertility across the drills in an east-w direction. No differences whatever could be discovered the sprouting of the two classes of tubers before planting, a although the early growth after planting showed variatio these appeared to be directly due to differences in fertility the soil rather than to the degree of maturity of the seed. T unevenness in early growth was quickly obliterated, and dur

Plan of Trial and Crop (in pounds) per Unit Row

E
Potatoes

	I	(100)	M	(131)
	M	(102)	I	(150)
	I	(98)	M	(131)
Kerr's Pink	M	(105)	I	(132)
	I	(110)	M	(130)
	M	(107)	I	(136)
	I	(115)	M	(127)
S	M	(113)	I	(152) N
	I	(89)	M	(116)
	M	(96)	I	(121)
	I	(92)	M	(120)
Great Scot	M	(87)	I	(121)
	I	(81)	M	(119)
	M	(77)	I	(110)
	I	(87)	M	(117)
	M	(81)	I	(111)

Potatoes
W

I = Immature Seed M = Mature Seed

Plan of the Trial Planting

most of the season the crop looked a remarkably uniform one. Out of the 1,792 plants in the trial, only one developed Leaf-Roll during 1929, none showed definite Mosaic, whilst a faint mottling which appeared in mid-season on some of the Kerr's Pink plants was fairly uniformly distributed and could certainly have had no appreciable effect on the yields. Lifting took place on October 1 and 2, and the tubers, after drying, were graded by hand into "ware," "seed" and "chats," before weighing.

In the variety Kerr's Pink, the mean total yields, per 56 plants, were 124 ± 5·06 lb. and 118·5 ± 2·9 lb. for immature and mature seed respectively. The difference in these means is 5·5 lb. which is less than the probable error (± 5·83 lb.) to which it is liable. Similarly, with the variety Great Scot, the mean total yields were 101·5 ± 3·8 lb. and 101·6 ± 4·3 lb., or a difference of only 0·1 lb. in favour of the mature seed; this difference itself being liable to an error of ± 5·7 lb. It may safely be concluded, therefore, that the small differences in total yields were not in any way due to a difference in quality in the immature and mature tubers planted.

The proportion of saleable tubers (*i.e.*, ware plus "seed") in the crops was also obtained. In the variety Great Scot the immature seed produced 1·0 per cent. more saleable tubers

than the mature seed, but it is clear that no significance can be attached to such a small difference, particularly as some error might be expected to arise from the grading operation. The variety Kerr's Pink showed a considerable amount of second growth due to the heavy rain in the late summer; but it is interesting to note that, despite this, there was no difference to be found in either total crop or proportion of saleable tubers from immature and mature sets.

Although the results of this trial suggest that no advantage is to be obtained from the use of immature tubers for seed purposes, it should be remembered that this is only the case when virus diseases are either absent from the crop, or occur in small amounts only in localities where transmission is negligible. Over the greater part of the British Isles, however, transmission of virus diseases is sufficiently rapid, in most seasons, to cause a distinct increase in disease in the tubers lifted after the tops have ripened off. For this reason, most growers who wish to save seed from their own crop will be well advised to rely only on early-lifted tubers for this purpose. Unfortunately, immature tubers do not keep so well, during storage, as mature tubers on account of the ease with which the thin skin is bruised, thus facilitating the entrance of tuber-rotting organisms. This loss in storage can be reduced to a minimum by care in handling and by storing the seed in boxes. Hutchinson[1] found no difficulty in storing immature seed in barrels or in clamps after it had been allowed to "green" on the surface of the drills for three weeks after lifting. It is very desirable to adopt this method of hardening the tuber skin when practicable; but, in any case, the writer would prefer to box the seed instead of storing in clamps.

Acknowledgments are due to Mr. J. F. Currie, and to my laboratory assistant, Mr. G. L. Turner, for the help they have given in the carrying out of this work.

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LIVE STOCK IMPROVEMENT SCHEME

REPORT FOR YEAR ENDING MARCH 31, 1930.

DURING the year ending March 31, 1930, the Live Stock Improvement Scheme was continued on similar lines to those described in previous annual reports, and further progress was made in those sections of the Scheme which relate to the provision of approved pedigree sires.

The fact that the numbers of bulls and boars located under the Scheme have been increased is all the more satisfactory in view of the low level of agricultural prices during the past year and the consequent necessity for farmers to curtail expenditure. Grants are paid by the Ministry in respect of the bulls and boars provided, but, even so, the purchase of pedigree animals necessitates additional outlay for those who provide the premium sires. In some districts also, owing to the lack of pedigree breeders in the locality, it is difficult or impossible for prospective purchasers to secure suitable animals for use under the Scheme except from a distance. Arrangements are made by the Ministry for its Live Stock Officers to purchase bulls and boars which are to be located under the Scheme, and in this way purchasers may avoid incurring heavy travelling expenses. The cost of carriage, if £2 or over in the case of bulls or £1 or over in the case of boars, is reckoned as part of the purchase price of the animals for the purpose of assessing the amount of the grant payable.

The increase in the number of applications for grants in respect of stallions hired by Heavy Horse Societies continued in 1929, and the number of subsidized stallions was larger than in any year, except 1918, since the Scheme was brought into operation.

As regards the section of the Scheme relating to milk recording, the desire of farmers to reduce their outgoings as much as possible at the present time has led to a further decrease in the membership of Milk Recording Societies, but, as previously reported, the majority of past members continue to record their cows privately. The average yield of the full-year cows recorded officially last year was the highest on record, *i.e.*, 690 gallons.

Bulls.—The number of bulls available for service under the Scheme during the year ended March 31, 1930, was 1,476, or 68 more than in the preceding year, and in the last five years there has been an increase of 407, or 38 per cent. The

average number of services per bull in 1929-30 was 65 as compared with 63 in 1928-29.

BULL SCHEME

Number of Bulls Subsidized each Year since the Commencement of the Scheme

Year (April 1 to March 31)	*No. of Bulls*	*Year (April 1 to March 31)*	*No. of Bulls*
1914–15	497	1922–23	947
1915–16	633	1923–24	978
1916–17	659	1924–25	1,069
1917–18	710	1925–26	1,175
1918–19	721	1926–27	1,287
1919–20	675	1927–28	1,372
1920–21	668	1928–29	1,408
1921–22	847	1929–30	1,476

Reference has been made in reports for previous years to the variation in different parts of the country in the readiness of farmers to take advantage of the Scheme and so secure better bulls for the service of their cows. On the whole the Scheme was welcomed most readily in the western and south-western counties of England and in Wales, where the proportion of small farmers who rear cattle is larger than in most of the other parts of the country. In these western areas the demand for grants continues and each year the number of premium bulls located has been increased. In recent years, however, small farmers in other areas, where interest in the Scheme developed more slowly, are now realizing the benefits to be derived from the use of good pedigree bulls, and many new Societies have been formed in these districts. For example, in the group of counties Norfolk, Cambridge, Huntingdon, Northampton, Bedford and Buckingham, there were only 64 Bull Societies in 1925-26, whereas last year there were 149. The Societies in the north of Buckingham have, in addition, shown themselves to be specially progressive. An annual show of premium bulls and their progeny has been organized and three successful shows have now been held. The stock exhibited has been a credit to the Scheme and has evoked much interest. Twenty Bull Societies have amalgamated recently to form the Bletchley and District Live Stock Improvement Society, which has initiated a scheme for the marking of calves sired by the premium bulls. It remains, however, to be recorded that there are still a number of counties, more particularly in the south-east and south, where Live Stock Officers have met with little success in their endeavours to interest farmers in the formation of Bull Societies under the Scheme.

The successes of premium bulls and their progeny at Shows, as well as the good prices received for stock sired by the premium bulls, has tended to popularize the Scheme among farmers. This year the list of successes is again a long one, and includes the best yearling and reserve championship for Devon bulls, and second prize and reserve championship for Guernsey bulls at the Royal Show, 1929, while at many County Shows the prizes for the best bull in the County were secured by premium bulls. The Secretary of a Society in a northern county reports that one of the members secured premier honours for two years in succession at the local Christmas fat stock show with steers sired by the premium bull, while another member of the same Society who reared four calves, two by the premium bull and two purchased, realized £5 per head more for those sired by the premium bull than for the other two when they were all sold as fat cattle.

Two references may be quoted from reports received as to the effect of premium bulls on the general run of cattle in the districts where they have been located. A few Bull Societies were formed in a district in one of the south-western counties where a few years ago the cattle were notoriously bad, and the Live Stock Officer is now informed by farmers and auctioneers that the difference in the cattle is very evident and they could not have believed that so great an improvement would have been effected in so short a time. In connexion with a competition in a north Midland county for the progeny of premium bulls, the judges, who had visited a large number of farms in the course of their duties, stated that they could not refrain from expressing their opinion on the wonderful improvement generally of the stock of each generation under the Live Stock Improvement Scheme.

Such reports are encouraging, but there are still very many farmers throughout the country who do not yet realize that it is more profitable to rear well-bred than badly-bred cattle. These farmers continue to use unsuitable bulls for the services of their cows and so breed cattle which cannot be expected to grow into satisfactory stock and can only be a source of disappointment and loss to the rearers. In this connexion it should be remembered that the number of premium bulls is less than 2 per cent. of all the bulls in use for service in the country.

Breeds and Prices.—The number and prices of the premium bulls according to breeds are given in the following table,

from which it will be seen that the average price of the bulls located on March 31, 1930, viz., £48 3s. 4d., was little different from that of the previous year. About 55 per cent. of the total number of bulls are of the Shorthorn breed, while Lincoln Red Shorthorns, Herefords and Devons each account for about 12 per cent. and Welsh Blacks for 5 per cent.

NUMBERS AND AVERAGE PRICES OF BULLS OF EACH BREED

Breed	1927–28				1928–29				1929–30			
	No.	Average Cost			No.	Average Cost			No.	Average Cost		
		£	s.	d.		£	s.	d.		£	s.	d.
Aberdeen-Angus ..	6	47	1	8	9	48	5	1	13	46	8	11
British Friesian ..	2	58	12	6	1	47	5	0	1	47	5	0
Devon	146	51	9	0	152	52	9	4	168	53	5	4
Galloway	1	19	19	0	1	27	6	0	1	24	3	0
Guernsey	16	41	5	3	18	39	15	5	16	41	10	7
Hereford	150	47	9	9	156	47	12	5	175	46	10	6
Lincoln Red ..	165	47	15	6	180	47	17	1	176	47	8	10
Red Poll	—		—		1	42	0	0	2	41	0	0
Shorthorn	752	49	15	1	764	49	8	1	800	49	5	9
South Devon ..	12	46	19	4	10	43	0	10	8	44	17	7
Sussex	3	35	7	0	5	39	11	10	5	40	6	5
Welsh Black ..	69	35	8	5	71	32	9	11	74	33	3	2
All breeds ..	1322	48	10	4	1368	48	4	5	*1439	48	3	4

* 1,476 bulls were located, but grants in respect of 37 were in suspense at the end of the year.

Service Fees.—The service fees charged for the use of the premium bulls ranged from 2s. 6d. to 10s. 6d., but only 25, or less than 2 per cent., exceeded 7s. 6d., while 79 per cent. were at 5s. or less.

Year	2/6	3/0	3/6	4/0	4/6	5/0	5/6	6/0	6/6
1927–28 ..	68	51	34	89	12	768	14	108	4
1928–29 ..	62	53	37	96	10	802	15	118	4
1929–30 ..	77	53	39	103	11	855	15	111	4

Year	7/0	7/6	8/0	8/6	9/0	9/6	10/0	10/6
1927–28 ..	13	138	6	2	—	—	13	2
1928–29 ..	11	132	7	2	—	—	16	3
1929–30 ..	7	139	8	1	—	—	13	3

Boars.—The number of boars provided for service unde the Scheme during the year ended March 31, 1930, was 972 an increase of 39 over the preceding year. The followin table shows the number of boars in respect of which grant

The demand from sow-owners for the provision of boars of the Large White breed continues to increase, and subsidized boars of this breed now number 665, or 70 per cent. of the total number of premium boars. This compares with 64 per cent. in 1929-30 and 47 per cent. four years ago.

There was little change in the average price of the premium boars in 1929-30, the average over all being £12 18s. 7d., while Large Whites averaged £13 2s. 11d.

Service Fees.—The service fees again ranged between 2s. 6d. and 10s., the usual fee being 5s., while the average over all continued to decline slightly, there being fewer fees of 7s. or over.

Year	2/6	3/0	3/6	4/0	4/6	5/0	5/6
1927–28	4	14	17	49	3	623	1
1928–29	3	12	16	60	6	654	1
1929–30	3	9	17	63	6	690	2

Year	6/0	6/6	7/0	7/6	8/0	8/6	10/0
1927–28	68	2	6	88	—	—	3
1928–29	65	3	4	87	—	—	6
1929–30	72	5	2	73	—	—	5

Rams.—The twenty-five grants which are made each year to Societies in Wales with the object of improving Welsh Mountain Sheep were again in request in 1929. Two new Societies were formed, one of these being in the western hill district of Monmouthshire where the hill sheep farmers had not previously been prepared to take advantage of the Scheme. As a result of the successful working of this Society in its first year farmers in two other parts of this area now wish to form Societies under the Scheme.

It is the practice of members of Societies to keep the best ram lambs from premium sires for mating purposes, and the good results obtained from the use of the premium rams and their progeny from carefully selected ewes has led many farmers outside the Scheme to use rams of higher merit than formerly.

The hiring fees of the rams used in 1929 ranged from £6 to £15, one Society securing for its use the highest priced ram at the Aberystwyth sale. The service fees ranged from 1s. to 3s. 6d. per ewe, but there were only four cases where the service fee exceeded 2s., and 17 of the rams served at a fee of 1s. or 1s. 3d. per ewe. The number of ewes served per premium ram was 60.

Horse Breeding.—*Heavy Horses.*—The steady increase since 1924 in the number of Heavy Horse Societies working under the Ministry's Scheme was continued in 1929, and a few Societies found it necessary to hire an additional stallion in order to meet an increased demand from farmers in their districts for the service of their mares. As a result, grants were paid in 1929 to 109 Societies travelling 120 stallions, an increase of six stallions as compared with 1928 and only two fewer than in 1918, when heavy horse breeding was at its highest point since a few years before the War.

HEAVY HORSE SCHEME

Service Season	No. of Stallions	Total No. of Mares served	Average No. of Mares served	No. of Assisted Nominations	Average Hiring Fee of Stallions £	Average Service Fee £ s. d.
1914 ..	72	6,365	68	1,503	231	2 8 6
1915 ..	97	9,122	94	2,430	241	2 9 6
1916 ..	108	9,995	92	2,181	244	2 11 0
1917 ..	110	10,556	96	2,151	258	2 16 3
1918 ..	122	12,281	100	2,165	285	2 15 8
1919 ..	118	10,920	96	1,996	317	3 6 3
1920 ..	105	9,133	87	1,839	345	3 13 1
1921 ..	101	7,888	78	1,943	333	3 13 7
1924 ..	87	6,098	70	*	178	2 7 0
1925 ..	96	7,413	77	1,723	194	2 8 4
1926 ..	98	8,165	83	2,171	208	2 8 6
1927 ..	105	8,950	85	2,599	211	2 8 9
1928 ..	114	9,792	86	2,805	217	2 9 4
1929 ..	120	10,196	85	3,052	221	2 9 9

* No grant was made by the Ministry for assisted nominations (except to the Cumberland and Westmorland Society) for the service season 1924.

The above figures do not include those relating to the Cumberland and Westmorland Society, which issues assisted nominations to selected stallions travelled by their owners in these counties. The numbers of such nominations issued by this Society each year since its formation in 1915 have been as follows :—

Service Season	*No. of Assisted Nominations*	*Service Season*	*No. of Assisted Nominations*
1915	385	1924	121
1916	394	1925	197
1917	328	1926	220
1918	321	1927	247
1919	264	1928	281
1920	254	1929	283
1921	255		

In addition to the particulars summarized in the tables above, Societies are required to furnish the Ministry with

have been paid each year, and it will be noticed that the number has been increased by 50 per cent. in the last five years :—

BOAR SCHEME

Number of Boars Subsidized each Year since the Commencement of the Scheme

Year (*April* 1 *to March* 31)	*No. of Boars*	*Year* (*April* 1 *to March* 31)	*No. of Boars*
1914–15	115	1922–23	569
1915–16	193	1923–24	638
1916–17	216	1924–25	655
1917–18	264	1925–26	710
1918–19	350	1926–27	844
1919–20	399	1927–28	907
1920–21	441	1928–29	933
1921–22	550	1929–30	972

As a result of the poor prices received for pigs in 1928, the number of pigs in the country was heavily reduced, and there were only 307,144 breeding sows on agricultural holdings in England and Wales at the beginning of June, 1929, as compared with 380,063 a year earlier. Consequently the number of sows sent for service to the premium boars declined, the average number of services per boar being 51 against 54 in the previous year. In these circumstances it is especially pleasing to record that more boar owners have been prepared to provide approved pedigree boars for the service of sows of small farmers and small-holders in their districts, in place of the unsatisfactory animals previously available.

Reports continue to be received of the improvement in the quality of the pigs in districts where approved boars have been located for a few years, and in some districts most of the classes at the local Christmas Markets are reported to have been won by the progeny of premium boars. An outstanding success during the past year was the securing of a 100-guinea cup and 25 guineas for the litter of pigs that would make one ton weight in the shortest time. This was won by a litter sired by a premium boar, while the dam and grand dam were both the progeny of boars which had been provided under the Scheme.

From the commencement of the Scheme until the end of 1927, the minimum age at which boars might be approved for location under the Scheme was six months, but in view of representations made to the Ministry the minimum approvable age was raised as an experiment to eight months. More than two years' experience of this increase in the minimum age has proved that the change is not helpful to the operation

of the Scheme. Owners of premium boars are not prepared to pay on an average more than £12 to £13 for a boar, and, while that sum is sufficient to purchase a useful boar for the purposes of the Scheme at six months of age, it does not suffice for the purchase of an equally good boar at eight months. In addition the cost of carriage on the older animal is appreciably greater, as a six-months-old boar can conveniently be sent in a crate, while an older boar must usually be forwarded by truck. Moreover, it is the practice of breeders, especially breeders on a small scale, to dispose of their boars before they reach the age of eight months, and purchasers of boars for use under the Scheme found that their choice was greatly restricted by the increase in the minimum age limit. In these circumstances the Ministry decided to revert to the minimum age limit of six months as from May 1, 1930. It should be mentioned that it is the usual practice of owners of premium boars to retain the outgoing boar until the young boar, which is purchased to take its place, is fit for regular use, and, hence, there is little risk of the young boar being overworked.

Breeds and Prices.—The table below shows the number and average prices of boars of each breed located under the Scheme in each of the last three years :—

NUMBER AND AVERAGE PRICES OF BOARS OF EACH BREED

Breed	1927–28				1928–29				1929–30			
	No.	Average Price			No.	Average Price			No.	Average Price		
		£	s.	d.		£	s.	d.		£	s.	d.
Berkshire	16	14	14	8	22	12	8	8	24	12	18	2
Cumberland ..	54	12	2	11	54	12	0	8	46	13	2	4
Essex	2	12	2	6	—		—		—		—	
Gloucester Old Spots	7	12	3	5	6	13	7	2	4	15	10	3
Large Black ..	57	11	14	11	47	11	18	7	44	11	14	3
Large White ..	532	13	14	11	589	13	4	8	665	13	2	11
Lincoln Curly Coated	29	10	9	3	27	9	10	6	21	10	5	7
Middle White ..	105	12	5	7	92	12	6	5	70	12	5	8
Large White Ulster	7	15	6	3	6	12	19	2	6	10	19	0
Tamworth	—		—		—		—		1	9	0	0
Wessex Saddleback	9	13	9	9	12	13	7	5	10	12	13	5
Welsh	60	12	12	3	4	10	17	9	3	10	13	4
Long White Lop-eared					58	13	2	7	53	11	7	6
All breeds ..	878	13	3	4	917	12	17	3	947*	12	18	7

* 972 boars were located, but grants in respect of 25 were in suspense at the end of the year.

returns showing the results of the services made by the subsidized stallions, and these returns indicate that on the average rather over 60 per cent. of the mares served in each of the years 1925 to 1928 proved in foal. It is of interest to note that the foal-getting percentage is higher in Wales than in England, the proportion in Wales being usually rather over 65 per cent. as compared with rather under 60 per cent. in England.

Reports received from the Ministry's Live Stock Officers indicate that the increased interest in heavy horse breeding in many parts of the country, which has been in evidence to some extent for the last year or two, is becoming more apparent. In one area, for example, where a new Society was formed to hire and travel a stallion in 1929, two stallions were travelled in 1930 and inquiries for the use of the stallions are reported to have been received from farmers who had not bred a foal for years. Further evidence that the decline in breeding is being checked is afforded by the annual agricultural returns, which show that there were 22,833 heavy foals in England and Wales in 1929, a small increase of 90 over 1928, as compared with reductions in each of the previous years since 1919. When, however, it is remembered that, in addition to the heavy horses in towns, there are about 700,000 horses on farms in this country which are used for agricultural purposes or for breeding, it would appear that the present rate of breeding is not sufficient to maintain the number of heavy horses now in use in the country.

As stated in last year's report, in order to give further encouragement to farmers to breed heavy horses, the maximum direct grant payable to Heavy Horse Societies has been increased for the 1930 season from £40 to £60 per stallion, and grants are payable this year in respect of stallions hired at a fee not exceeding 400 guineas and serving at a fee not exceeding 4 guineas as compared with the corresponding maxima from 1924 to 1929 of 300 guineas and 3 guineas, respectively.

Horse Breeding Act, 1918.—The decline in the number of stallions licensed under the Horse Breeding Act, 1918, which had been continuous for seven years, was checked in 1929, when 1,436 stallions were licensed in England and Wales as compared with 1,414 in the previous year. The number of licences issued and the number of refusals in each year since the Act came into force have been as follows :—

Year (ending October 31)	*No. of Applications for Licences*	*No. of Licences issued*	*No. of refusals*
1920	4,153	3,749	404
1921	4,060	3,816	244
1922	3,644	3,479	165
1923	2,897	2,761	136
1924	2,285	2,210	75
1925	1,908	1,849	59
1926	1,664	1,608	56
1927	1,574	1,537	37
1928	1,454	1,414	40
1929	1,472	1,436	36

The whole of the increase in 1929 was in heavy stallions, of which 1,089 were licensed against 1,033 in 1928, while light stallions numbered only 347, a decrease of 34. Shires accounted for the greater part of the increase in heavy stallions, 760 of this breed being licensed against 720 in 1928, and Clydesdales increased by 13 to 133. The reduction in light stallions was in Hackneys and Ponies, the former declining from 63 to 45 and the latter from 125 to 105. Thoroughbreds again showed a small increase.

The number of stallions of each breed or type licensed for the 1929 season and the number rejected were as follows :—

NUMBER OF STALLIONS LICENSED OR REFUSED IN ENGLAND AND WALES

Heavy	*Pedigree*		*Non-Pedigree**	
	Licensed	*Refused*	*Licensed*	*Refused*
Shire	716	18	44	2
Clydesdale ..	127	—	6	—
Suffolk	127	6	2	—
Percheron ..	41	1	—	—
Others	—	—	26	3
Total Heavy ..	1,011	25	78	5
Light				
Thoroughbred ..	164	5	2	—
Hackney	39	1	6	—
Arab	12	—	2	—
Hunter	1	—	2	—
Cleveland Bay ..	4	—	—	—
Yorkshire Coach ..	2	—	—	—
Welsh Roadster ..	1	—	1	—
Others	—	—	6	—
Ponies (including Welsh Cobs) ..	93	—	12	—
Total Light ..	316	6	31	—
Grand Total ..	1,327	31	109	5

* Non-Pedigree Stallions are arranged as far as possible under types.

It was found necessary to refuse the issue of licences in respect of only 36 applications, the number of refusals being lower than in any previous year. The reasons for the rejection of these 36 stallions were as follows :—

Roaring	8	Stringhalt	3
Whistling	8	Bone Spavin	1
Sidebone	6	Inadequately Prolific	1
Cataract	5	"Tubed" and could not be examined for wind	1
Ringbone	3		

Appeals against refusals were lodged in 12 cases, of which 6 were successful.

Only 14 cases of infringement of the Act were reported to the Ministry during the season, this being a reduction of 4 on the year. The reports received related to 4 unlicensed stallions which were being exhibited for service on premises not in the stallion owner's occupation, and to 10 licensed stallions which were being travelled unaccompanied by the licences. No unlicensed stallion was found on the road.

Milk Recording.—The number of members of Milk Recording Societies in each year since 1917-18, when all Societies were required to adopt a uniform milk-recording year, together with the number of herds and cows recorded have been as follows :—

Year ended October 1	*Societies*	*Members*	*Herds*	*Cows*
1917–18	27	639	708	19,793
1918–19	38	1,191	1,332	37,880
919–20	46	2,075	2,312	61,323
1920–21	52	3,328	3,664	97,903
1921–22	55	3,949	4,362	117,023
1922–23	55	4,365	4,767	127,151
1923–24	52*	4,764	5,209	138,086
1924–25	50*	5,081	5,516	148,905
1925–26	49*	5,174	5,656	154,322
1926–27	51†	5,166	5,650	156,847
1927–28	50‡	4,862	5,320	149,971
1928–29	50	4,616§	5,065§	144,812

* The decrease in the number of Societies was due to amalgamation.

† The increase in the number of Societies was due to the dividing of one Society covering three counties into separate Societies for each county.

‡ The decrease in the number of Societies was due to a Society ceasing operations.

§ Including 37 members recording goat herds only.

The decline in membership, which occurred in 1927-28, was continued in 1928-29, but the decrease was not as large as in the previous year. As indicated in the opening paragraphs of this report, these reductions are attributable to

the present financial stringency amongst farmers, and on information available it appears that those who have resigned from Milk Recording Societies usually continue to record the milk yields of their cows. In this connexion, it may be mentioned that, although the number of members has decreased in the last two years, recruitment of new members has not been at a standstill. Each year an appreciable number of cow-owners, who have not previously had any experience of recording, have commenced to record under the Scheme, so that the number of farmers in the country with practical experience of the value of recording is continually being increased.

There are several schemes in operation under which bonus payments are made by milk buyers for milk of a high standard of cleanliness and butter fat content, and an article on this subject, which included outlines of the schemes in operation, was published in the issue of this JOURNAL for September, 1929. Mention may be made here of a bonus scheme which was commenced in October, 1928, and in its first year was available only to members of the Suffolk Milk Recording Society, but which has now been extended to include members of the Norfolk Society. Under this scheme, which was introduced by one large buyer and is now being adopted by other buyers in these counties, an additional 20s. per 1,000 gallons is paid for milk with a bacterial count not exceeding 250,000 per c.c.; *B. coli* absent in 1/100 c.c.; and a butter fat content of 3·2 per cent. for morning milk and 3·8 per cent. for evening milk. The samples are taken by the recorders in the ordinary course of their visits. During the past year another Society organized a meeting with buyers of milk produced in their area, the object being to encourage variation in the price paid for milk according to quality, and it is hoped that this will lead to extension in that direction. Any steps taken by Milk Recording Societies to secure better prices to producers for milk of improved quality are all to the good, and should encourage more cow owners to commence recording and become members of Societies.

Average Yield of Recorded Herds.—The number of cows recorded under the Ministry's Scheme in 1928-29 was 144,812 of which 74,171 were cows which had been in the recorded herds for the whole of the year. The following table compares the average yield of (1) all cows and heifers recorded, and (2) cows recorded for the full year, for each year since the uniform milk recording year was introduced :—

Year Oct. 1 to Oct. 1	Particulars of all cows and heifers recorded			Particulars of cows recorded for full year			
	No. of cows and heifers	Total yield	Average yield *	No. of cows	Percentage of total cows and heifers	Total yield	Average yield *
		Gal.	Gal.			Gal.	Gal.
1917–18	19,793	8,426,958	426	8,775	44	5,255,923	599
1918–19	37,880	16,204,941	450	17,989	47	10,543,516	579
1919–20	61,323	29,344,887	479	27,266	44	17,363,347	637
1920–21	97,903	48,512,380	495	48,248	49	30,892,620	640
1921–22	117,023	60,463,617	517	63,318	54	41,208,073	651
1922–23	127,151	67,904,224	534	68,349	54	46,956,565	687
1923–24	138,086	73,963,165	535	73,338	53	50,299,884	685
1924–25	148,905	76,419,498	*513	77,132	51	51,695,291	*670
1925–26	154,322	81,623,788	*529	81,669	53	56,102,434	*687
1926–27	156,847	82,161,809	*524	81,749	52	55,677,261	*681
1927–28	149,971	76,896,131	*513	77,171	51	51,931,633	*673
1928–29	144,812	75,948,485	*524	74,171	51	51,207,594	*690

* Before 1924–25 the average yield was calculated at the equivalent of 10¼ lb. to a gallon and subsequently at 10⅓ lb.

The average yield of full-year cows in 1928-29 was 7,134 lb. (690 gallons) which exceeded the highest average previously attained by 3 gallons, and was 17 gallons higher than in 1927-28. Increased average yields were secured by 43 of the 50 Societies, and in each of the remaining 7 Societies the decrease was small. Eight Societies, as compared with only three in the previous year, had average yields exceeding 7,500 lb. (726 gallons) per cow. Durham had the highest average with 8,051 lb. (779 gallons) followed by Derby and District with 7,986 lb. (773 gallons) and Norfolk, Suffolk and Northumberland with 7,794 lb. (754 gallons), 7,777 lb. (753 gallons) and 7,747 lb. (750 gallons), respectively. Individual herds with average yields for full year cows of 8,000 lb. (774 gallons) or over numbered 1,121, or nearly 25 per cent. of the total number of herds recorded for the full year, as compared with only 20 per cent. in the previous year, while there were 178 herds with average yields of over 10,000 lb. (968 gallons) per cow.

Some indication of the increases which can be effected in the average yields of herds as a result of the elimination of low yielding cows, more attention to breeding, selection and feeding, and the increased interest of stockmen, which usually follow the adoption of milk recording, may be gauged from

the following particulars obtained from the returns of five herds, which have been recorded for a few years.

Herd	No. of years during which records have been taken	Average yield per cow in first year	Average yield per cow in last year	Increase in annual average yield per cow	No. of full year cows in last year of period	Cash value of increase of last year over first year at 1s. per gallon	
						per cow	per herd
		Gal.	Gal.	Gal.		£ s.	£ s.
A. (Pedigree Friesian) ..	10	803	1,094	291	26	14 11	378 6
B. (Pedigree Jersey) ..	9	549	978	429	11	21 9	235 19
C. (Pedigree Red Poll) ..	6	694	979	285	13	14 5	185 5
D. (Non-Pedigree Shorthorn)	5	733	1,028	295	10	14 15	147 10
E. (Non-Pedigree Shorthorn)	4	801	973	172	15	8 12	129 0

The tabulation of the records according to the breeds of the cows shows that each breed gave a higher average yield than in 1927-28. Friesians with an average of 8,383 lb. (811 gallons) per cow again headed the list, while Shorthorns, the most numerous breed, averaged 6,986 lb. (676 gallons) pe

Total number of Cows and Heifers of certain breeds recorded in Englan and Wales during the year ended October 1, 1929, and the number and averag yield of Cows recorded for the full year, together with the percentage of ful year Cows.

Breed or Type	Total number of cows and heifers recorded	Particulars of cows recorded for full year			
		Number	Percentage of total cows and heifers	Total yield	Average yield
				lb.	lb.
Ayrshire ..	2,700	1,430	52·9	10,487,700	7,334
Blue Albion ..	1,263	662	52·4	4,992,885	7,542
Devon ..	1,312	825	62·8	4,690,842	5,686
Friesian ..	22,477	12,170	54·1	102,023,259	8,383
Guernsey ..	8,030	3,702	46·1	23.485,447	6,344
Jersey	5,169	2,512	48·5	15,699,868	6,250
Lincoln Red ..	2,911	1,561	53·6	11,118,494	7,123
Red Poll ..	5,393	3,000	55·6	21,051,893	7,017
Shorthorn ..	89,609	45,391	50·6	317,114,177	6,986
South Devon ..	2,268	1,000	44·0	6,746,658	6,747
Welsh Black ..	1,023	588	57·4	3,348,878	5,69

cow. Of the total number of cows and heifers recorded, Shorthorns accounted for 62 per cent., Friesians over 15½ per cent., Guernseys 5½ per cent., and Red Polls and Jerseys 3¾ and 3½ per cent. respectively, these proportions being much the same as in the previous year.

Issue of Certificates.—More Certificates of Merit were issued than in any previous year, the total of 292 Certificates in respect of the three years ended October 1, 1929, showing an increase of 37 on the year. These certificates cover a period of three consecutive milk-recording years and are only awarded in respect of cows which have given the prescribed yield of milk for their breed or type and have produced calves regularly during that period. More than one-half of the cows in respect of which Certificates of Merit were issued gave over 30,000 lb. of milk in the three-year period, the highest yields certified being 65,467 lb., 57,913 lb. and 50,738 lb., given by Friesians, and 49,601 lb. and 49,086 lb. by Shorthorns.

There was also an increase in the number of applications for Certificates of Milk Record, which certify the milk yield of a cow for one year only, 93 of such certificates being issued in respect of the year ended October 1, 1929, against 61 for the previous year.

Register of Dairy Cattle.—Although the total number of cows recorded in 1928-29 was smaller than in 1927-28, the number of cows which qualified for entry in the Ministry's Annual Register of Dairy Cattle increased from 13,539 to 15,065. Shorthorns numbered 8,299, an increase of 654, and Friesians 3,377, an increase of 372, these two breeds accounting for 77 per cent. of the cows eligible for entry. There were 8,605 cows with yields of 10,000 lb. or over, as compared with 7,652 in 1927-28. The number of entries in the Register was again limited to 7,500, so that only 50 per cent. of the eligible cows could be included in Volume XIII. Included in this Volume are 22 cows which gave over 20,000 lb. of milk in the year and 273 which yielded between 15,000 and 20,000 lb.

In a separate section of the Register particulars are given of the cows in respect of which Certificates of Merit were awarded.

The number of bulls entered in the Register is 153. Bulls entered for the first time number 31, of which 24 qualified through their dams and sire's dams having given not less than the standard yield prescribed for their breed or type, and 7 through having two or more daughters which have given not less than the standard yields.

Rationing.—The benefits to be derived from the use of scientifically balanced rations, and the feeding of individual cows according to their yields become more widely known amongst members of Milk Recording Societies. Each year additional members seek advice on the subject from County Agricultural Organizers or other authoritative sources, while many who have previously sought such advice are now able to make up properly-balanced rations themselves and need help only in special circumstances. It is reported that nearly 60 per cent. of the members of one Milk Recording Society now feed balanced rations, and over the whole country much economy in the production of milk must have resulted from the use of milk records as a guide to supplying cows with suitable rations in accordance with their yields.

Testing for Butter Fat.—The number of samples taken by Recorders for testing for butter fat was rather smaller than in 1927-28, which is no doubt attributable to the reduction in the number of herds recorded. The decrease was, however, comparatively small, some 125,191 samples being taken as compared with 128,526, and the number exceeded that of two years earlier, when more cows were recorded, by 13,015. Of the total number of tests for butter fat over 102,000 were in respect of the yield of individual cows. The charge made to members by Societies for milk sampling is usually from 3d. to 6d. per sample.

Calf and Bull Marking.—The number of calves marked in 1928-29 under the Ministry's Scheme for the registration and marking of calves of milk-recorded cows was 13,483, a decrease of 461 on the year. Most of the calves marked were again heifer calves, under 1,100 being bull calves. The number of bulls being used for service by members of Milk Recording Societies, and which were marked under the Scheme in 1928-29, was 33.

Cost of Milk Recording.—There was practically no change in the average cost of milk recording per cow over the whole country in 1928-29. The average cost to the Societies was 6s. 3d. per cow, of which the members provided 4s. 2d. per cow while the Ministry's grants averaged 2s. 1d. per cow.

MILK RECORDING SOCIETIES

Statement giving particulars of the 50 Milk Recording Societies operating during the year ended October 1, 1929.

(The Societies are arranged in order of total number of animals recorded)

Society	*No. of members	*No. of herds	Total No. of cows recorded	No. of cows recorded for full year	Average yield of cows recorded for full year
					lb.
Essex County ..	208	240	9,789	5,174	7,665
Hampshire	204	232	8,016	4,265	6,568
Suffolk	260	286	7,527	4,196	7,777
Somerset and North Dorset	207	236	7,304	4,216	6,711
Berkshire	162	191	6,530	3,345	6,901
East Sussex	198	227	6,450	3,397	6,817
Norfolk	214	234	6,411	3,804	7,794
North Wilts ..	102	130	6,122	3,085	6,712
Hertfordshire County	156	182	5,485	2,645	7,325
West Sussex ..	126	146	4,777	2,264	7,355
Kent	145	164	4,617	2,226	6,913
Dorset	72	101	4,279	2,662	6,526
Surrey	144	151	4,207	2,016	6,979
Warwickshire ..	137	145	3,606	1,778	6,998
Lancashire County ..	105	113	3,499	1,281	7,210
Oxfordshire	102	108	3,387	1,816	7,158
Gloucestershire ..	106	115	3,262	1,749	7,370
Leicestershire and Rutland	106	111	3,097	1,459	7,079
Shropshire ..	79	85	3,049	1,595	7,422
Buckinghamshire ..	96	101	2,647	1,247	7,366
Yorkshire	99	105	2,518	1,056	7,374
South Devon and District	98	104	2,285	1,018	6,726
Northamptonshire ..	77	84	2,192	1,028	6,899
Cambridgeshire and District	72	82	2,179	1,072	7,395
South Wilts	32	47	2,163	1,196	7,255
Cheshire County ..	64	68	2,126	967	7,446
Derby and District ..	60	61	2,083	932	7,986
Staffordshire ..	60	62	2,009	951	7,568
Bristol and North Somerset	82	86	1,865	1,051	6,787
Cumberland and North Westmorland	94	95	1,682	711	5,702
Worcestershire ..	76	78	1,645	837	7,328
Nottinghamshire ..	44	46	1,567	617	7,175
Bedfordshire ..	52	56	1,556	822	7,460
Northumberland ..	66	67	1,519	740	7,747
Lincolnshire ..	43	46	1,377	751	7,472
Durham County ..	46	50	1,230	512	8,051

Society	*No. of members	*No. of herds	Total No. of cows recorded	No. of cows recorded for full year	Average yield of cows recorded for full year
					lb.
East Devon	66	66	1,216	718	6,709
Peak (Derby) ..	54	55	1,137	507	7,492
Monmouthshire and Brecon	52	52	1,129	567	7,382
Cornwall	67	67	1,105	553	6,316
Herefordshire ..	44	45	1,035	542	7,085
Denbighshire and Flintshire	42	44	989	582	6,775
Kendal and South Westmorland ..	42	43	898	323	5,599
Anglesey and Caernarvonshire ..	54	54	704	389	5,796
Glamorganshire ..	41	41	569	313	7,538
Campden, Moreton and District (Gloucester) ..	26	26	531	329	7,191
Carmarthenshire ..	26	28	499	310	7,145
Cardiganshire ..	40	40	468	274	6,240
Montgomeryshire ..	17	18	267	152	6,604
Pembrokeshire ..	14	14	208	131	6,567
TOTALS	4,579	5,028	144,812	74,171	7,134

* Herds of goats are not included.

Exportation of Live Stock to Countries Abroad.—The changes in the regulations of countries abroad that had most influence on our export trade in live stock during the year 1929-30 were the total prohibition of imports into Canada and the United States for about six months from September to March, owing to outbreaks of foot-and-mouth disease in England and Scotland, and the acceptance by Australia of stock from England through the Quarantine Station. The latter resulted in the export of over 400 pedigree animals to Australia; the former caused great inconvenience to exporters by delaying shipments, but, owing to the dispatch of large consignments immediately after the removal of the embargo, the total exports to Canada and the United States during the year exceeded the previous year's total by nearly 200. A number of other countries amended their regulations regarding imports of animals during the year, and these alterations were almost always in the direction of stricter

certification, the usual requirement being that the certificates should either be given by the Ministry itself as the central authority dealing with diseases of animals in this country, or that the Ministry should accept responsibility for them. The number of certificates issued in 1929-30 was 958.

The number and declared value of cattle, sheep and pigs exported for breeding purposes from Great Britain and Northern Ireland to each country abroad are published each quarter in this JOURNAL. The following table shows the total exports (exclusive of those to the Irish Free State) for the calendar years 1929 and 1928 :—

	1929		1928	
	No.	*Value* £	*No.*	*Value* £
Cattle	1,477	169,338	1,152	115,185
Sheep	3,878	72,052	3,044	54.539
Pigs	411	9,232	340	8,477

The following memoranda, which give detailed information concerning the live stock operations of the Ministry, can be obtained (single copies free of charge) on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1 :—

Leaflet 282 : Scheme for the Improvement of Live Stock.
Leaflet 146 : The Value of Records of the Milk Yields of Cows.
No. 609/T.L. : Bull Grant Regulations.
No. 392/T.L. : Milk Recording Regulations.
No. 466/T.L. : Boar Grant Regulations.
No. 89/T.L. : Heavy Horse Regulations.

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THE CONTROL OF CAPSID BUGS ON BLACK CURRANTS *

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DURING past years, the problem of control of Capsid Bugs on black currants has received considerable attention from various workers. In spite, however, of their efforts, the injury caused by Capsid Bugs to black currants has, year by year, assumed more serious proportions, until many plantations have now become practically ruined. The damage in question is caused by two species of Capsid Bugs, namely, *Lygus pabulinus*, generally known as the Common Green Capsid Bug, and *Plesiocoris rugicollis*, the well-known Apple Capsid Bug. The former species is the more abundant on black currants, although in the West of England *P. rugicollis* is generally also present.

The respective life-histories of these species of Capsid Bug are well known, and have been described in a series of articles by F. R. Petherbridge and other workers.[1]

In general, the life-histories of the two species are somewhat similar. The eggs are laid embedded in the bark of the younger shoots of woody plants and pass the winter in this situation. Hatching commences in April, the young bugs appearing over a variable period. *P. rugicollis* has only one generation per year, but *L. pabulinus* has two, the second brood of eggs being laid in a great variety of succulent plants. In consequence, *L. pabulinus* increases at a greater rate than does *P. rugicollis*.

Both these species of Capsid Bug cause injury to the black currant by sucking, which, in the earlier stages, causes yellowish mottling and distortion of the foliage. Dead areas are subsequently produced and the leaves become riddled with holes. Later in the season, the effect of their activities is reflected in the type of growth produced by the bush. Owing to the damage caused to the terminal portion of the original shoots, a considerable proportion of lateral buds are forced into growth, practically all the later development of the bush taking the form of side-shoots.

Previous Methods of Control.—Until recent years, control measures have taken the form of spring spraying with contact washes such as nicotine-soap mixtures. To obtain good

* The experiments described in this article are of a preliminary character.

results with such a wash, the application of a considerable amount of fluid by an experienced workman is necessary, and more than one spraying may be required.

With the advent of winter washes of the tar-distillate type, attempts were made to control Capsid Bug on black currants by their use, but without success.

Recently, however, it has been shown by two of the writers[2] that a tar-distillate wash, prepared from the high-boiling, neutral fraction of a tar, is capable of effecting a measure of control of Capsids on black currants. Although this was not entirely satisfactory, it gave indications of promise. For instance, it was found that by using the improved type of tar-distillate wash in 10 per cent. concentration, a 70 per cent. attack could be reduced to one of only 20 per cent.

It was very evident that endeavours should be made to improve still further the moderate measure of control which had been obtained by means of the winter wash, and with this object in view a new variant of tar-distillate wash was prepared and field trials have been conducted with it.

New Form of Wash Employed.—It has already been pointed out by the writers[3] that a good control of Capsid Bug has been obtained by means of certain winter washes made from petroleum products, but that such washes failed to control Aphis and Psylla. It is well known, however, that control of the latter pests may readily be effected by means of a comparatively dilute concentration of a tar distillate wash. From these and certain other considerations, it appeared probable that a winter wash of wider utility than those prepared from petroleum products, or from tar distillates alone, might be prepared by employing a mixture of these two liquids as a basis for the wash.

A mixture containing equal parts by volume of a high-boiling neutral tar oil and a heavy paraffin was, therefore, prepared. The neutral tar oil used was supplied by the South Metropolitan Gas Co., and was obtained from a horizontal retort tar. It contained only a trace of "tar acids" and had been deprived of excess of anthracene by cooling. It was collected during distillation between 280° and 360° C.

The heavy paraffin used was "Shell White Oil P.2," for a supply of which we are indebted to the British Dyestuffs Corporation, Ltd. It had the following characteristics :—

Specific Gravity at 15° C.	0·865
Flash point (closed)	275° F.
" " (open)	305° F.

Viscosity, Redwood 1 at 70° F.	130 secs.
Iodine value (Wijs.)	1·1 per cent.
Sulphur (calculated as such)	0·2 "

On distillation it commenced to boil at about 290° C., but only 26·4 per cent. by volume passed up to 360° C. It is therefore seen that the greater part of this heavy paraffin oil is even less volatile than the high-boiling neutral tar oil employed, a fact which would prolong the period during which a film of it would persist on the twigs and insect eggs after the trees had been sprayed.

For the purpose of emulsifying this mixture of "high neutral" tar oil and heavy paraffin, a procedure, precisely similar to that described in the case of the "high neutral" tar oil wash, was employed (*loc. cit.*, p. 133). Eighty-five parts by volume of the mixture of oils was thoroughly mixed with 15 parts by volume of Agral W.B., and, when emulsification was to be effected, 3 oz. of caustic soda were employed for every gallon of the concentrate. The emulsion obtained from this new mixture was even superior to that yielded by the plain tar oil wash.

This wash will be referred to throughout the remainder of this article as the tar oil-heavy paraffin wash.

Field Trials, 1930.—Field trials with the tar oil-heavy paraffin wash were conducted during the winter 1929-30 at two centres, using a 10 per cent. emulsion of the mixture described above. A plot was included at Centre I on which the ordinary two-solution, high-boiling neutral tar-distillate wash, as used in the previous year's trials, was employed for purposes of comparison.

CENTRE I.—Newnham-on-Severn, Glos.
Variety : Baldwin.

The treatments carried out at this centre were as follow :—

(1) High boiling, neutral tar-distillate wash (two-solution) at 10 per cent. strength. No. of bushes 32.
(2) Tar oil-heavy paraffin wash (two-solution) at 10 per cent. strength. No. of bushes 94.
(3) Tar oil-heavy paraffin wash (two-solution) at 12 per cent. strength. No. of bushes 36.
(4) Controls, in two plots of 61 and 48 bushes respectively.
Total number of bushes in trial, 271.
Date of application of the sprays, February 5, 1930.

The sprays were applied by means of a sprayer of the "headland" type, the weather at the time of spraying being favourable.

CENTRE II.—County Council Experiment Station, Perdiswell, Worcester.
Varieties: Goliath, French, Baldwin, Seabrook's Black and Edina.

The varieties were in recurring series of rows and all of them occurred within the sprayed and unsprayed plots.

The treatments carried out at this centre were as follows :—

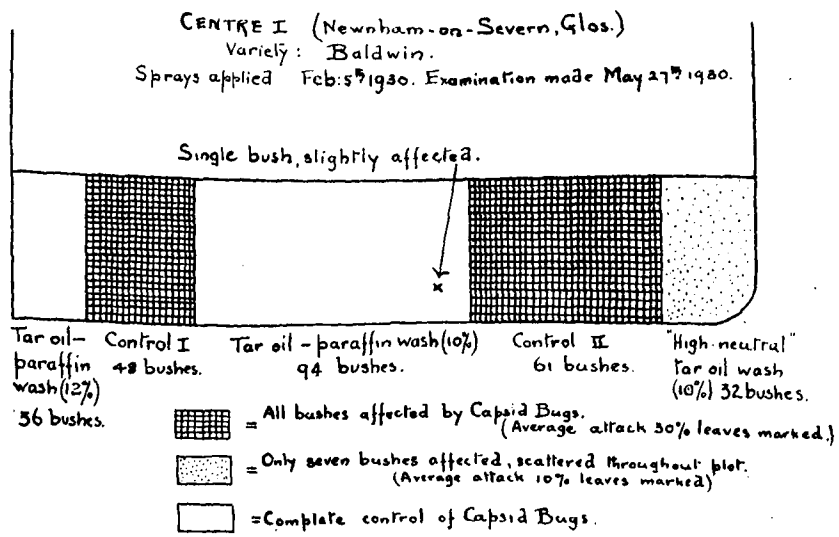
(1) Tar oil-heavy paraffin wash (two-solution) at 10 per cent. strength. No. of bushes 42.
(2) Control plot. No. of bushes, 44.
Total number of bushes, 86.
Date of application of the sprays, February 6, 1930.

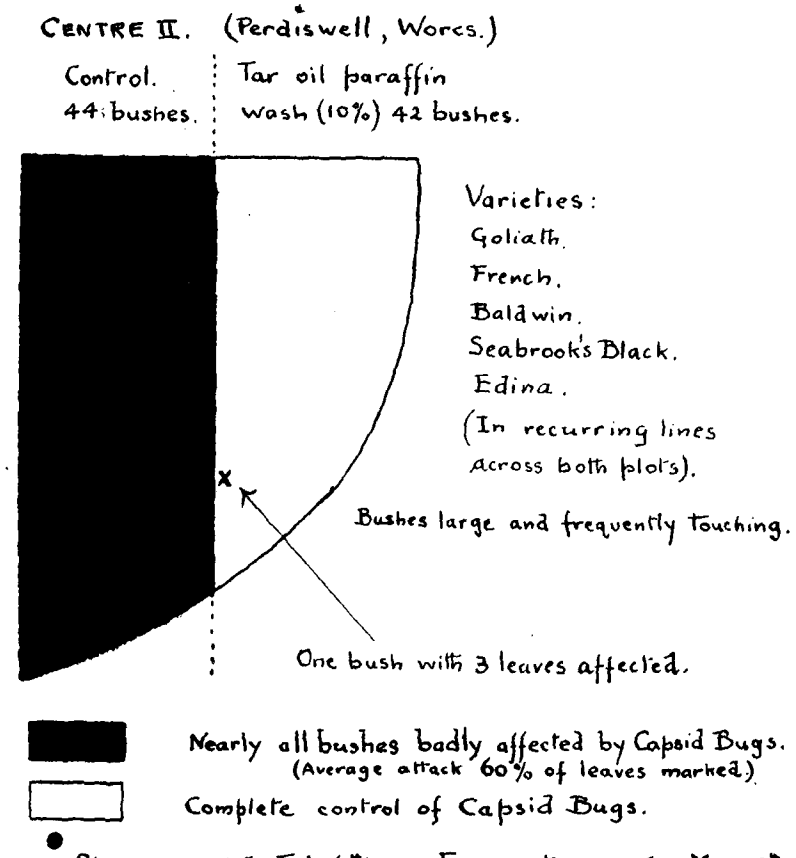
The spray was applied at this centre also by means of a "headland" sprayer, during fine, dry weather.

Lygus pabulinus and *Plesiocoris rugicollis* were present at each centre, though the former species predominated. No other pest was present in appreciable numbers.

Results.—The results obtained by examinations on May 27 and 28 are shown in Diagrams I and II, together with the layout of the plots.

It will be seen from the diagrams of the plots on which the experiment was conducted that a practically complete control of Capsid Bugs on black currants has been effected by the use of the tar oil-heavy paraffin winter wash at 10 per cent. strength. The results obtained by means of the high-boiling neutral tar-distillate wash are comparable with those obtained during the field trials of 1928-29.





The bushes at Centre II were very large and all varieties were heavily infested. At the time of examination a number of bushes on the control plot showed over 80 per cent. of leaves injured by Capsid Bugs, a large proportion for so relatively early a date. Notwithstanding the heavy infection of this plot with Capsid Bugs, it will again be seen that a practically complete control of these pests has been effected.

At neither centre could any evidence of spray damage be detected.

Summary.—The preparation of a winter wash from a mixture of high boiling, neutral tar oil and a heavy paraffin oil is described.

This new wash emulsifies very well and gives an excellent "spread" and "cover" on the trees. When used in 10 per cent. concentration on black currant plantations it has effected a practically complete control of Capsid Bugs. The results

obtained are of so highly satisfactory a nature that it has been deemed desirable to bring them to notice in time to enable the wash to receive extended trial next year.

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[2] Staniland, L. N., and Walton, C. L. : *Jour. Min. Agric.*, Sept., 1929.

[3] Staniland, L. N., Tutin, F., and Walton, C. L. : *Jour. of Pomology*, VIII, 1930, p. 150.

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MARKETING NOTES

National Mark Egg Scheme.—During the months March-June, 1930, inclusive, the total output of the packing stations was little short of 100 million eggs, of which over 70 per cent. were packed under National Mark labels. This shows a definite increase compared with last year. Since National Mark Egg Central, Ltd., began to function as a sales agency in March, large quantities of National Mark eggs have been disposed of by its accredited agents. These eggs have mainly passed into new trade channels as far as home produce is concerned, and one effect of this has been to prevent any sign of a glut on wholesale markets during the flush season, thus helping to sustain the price level of National Mark supplies. The position in the markets attained by National Mark eggs is denoted by the wide price-margin that now exists between them and ungraded home produce.

National Mark Dressed Poultry.—Poultry packed under this scheme are now arriving on the markets, and reports indicate that consignments have been well received in the London and Birmingham (Smithfield) Markets. The first consignment to be sent to Smithfield Market, London, arrived on the morning of June 25. Its success was immediate and striking, every available bird being bought by buyers from the large London stores. As one buyer said : "There are no finer poultry than English, and this National Mark guarantee of origin and quality will help our shops to gain the goodwill of customers." A photograph of a portion of this consignment is reproduced opposite ; also a close-up photograph of one of the birds, which shows how the National Mark seal and disc are affixed. Inquiries concerning the scheme have been received from poultry packers in various parts of the country, and additions to the list of authorized packers may be anticipated shortly.

National Mark Dressed Poultry: Part of first consignment received at Smithfield Market,

National Mark Dressed Poultry: Close-up view of a bird, showing correct method of dressing with the National Mark seal and disc affixed.

National Mark Beef.—The number of sides of beef graded and marked with the National Mark for the four weeks ended July 19, 1930, was as follows :—

Week ended	*Select*	*Prime*	*Good*	*Total sides graded and marked (Including quarters and pieces in terms of sides.)*
		LONDON		
June 28 ..	641	1,270	71	1,982
July 5 ..	619	1,074	81	1,774
„ 12 ..	633	1,010	64	1,707
„ 19 ..	689	930	51	1,670
		BIRKENHEAD*		
June 28 ..	22	133	—	155
July 5 ..	31	146	—	177
„ 12 ..	12	163	—	175
„ 19 ..	30	177	1	208
		SCOTLAND*		
June 28 ..	1,969	455	—	2,424
July 5 ..	1,798	486	—	2,284
„ 12 ..	1,738	450	—	2,188
„ 19 ..	1,941	580	—	2,521
		TOTAL LONDON SUPPLIES (*All Sources*)		
June 28 ..	2,632	1,858	71	4,561
July 5 ..	2,448	1,706	81	4,235
„ 12 ..	2,383	1,623	64	4,070
„ 19 ..	2,660	1,687	52	4,399
		BIRMINGHAM		
June 28 ..	17	114	7	138
July 5 ..	18	97	4	119
„ 12 ..	20	92	16	128
„ 19 ..	30	105	13	148

* Sides consigned to London

The trade in National Mark beef has been satisfactory. In spite of the hot weather, when the demand for beef usually declines, supplies of National Mark beef at Smithfield have been maintained both as regards quantity and quality.

The improved price for "Select" English beef has been maintained. A valuable market has, in fact, been created in London for a class of cattle which, before the National Mark Scheme came into operation, seldom reached the London area. An interesting example of this development occurred when a consignment of 28 cattle of exceptional quality was recently sent to Islington from the Eastern Counties. These cattle were all two years old or under and of the conformation, quality and finish most required by the town trade. The carcasses were graded "Select" and actually made about 4d. per stone above the price of any other beef, including Scotch,

on the market. It will be a matter of some interest to agriculturists to know that these exceptionally fine cattle were pure-bred Lincolnshire Reds.

The Birmingham situation remains more or less unchanged. Grading and marking are being continued at the Ministry's Stand in the Wholesale Meat Market and in private slaughter-houses.

National Mark Apples and Pears.—It is anticipated that, although this year's crop will not be large, the quantity of apples suitable for grading will be greater than last year owing to the extensive "thinning" and spraying operations which have been carried out in established orchards in many parts of the country. It is the generally accepted view that the scheme has already more than justified itself in the improvement which it has induced in the quality of English apples sent to market.

National Mark Tomatoes and Cucumbers.—National Mark tomatoes and cucumbers have been reaching the markets in large quantities and have met with a satisfactory demand, thus reflecting the welcome which the fruit trade is extending to all National Mark fruits. Supplies are of excellent quality and prices good, while it has become evident that distribution this year is very widespread.

National Mark Strawberries.—Nearly 100 growers have been enrolled in the Scheme during this experimental first season, and the fruit marketed under the Mark has met with an excellent demand, good prices being realized. Distributors, both wholesale and retail, have been keenly interested in view of the prevalence in the past of topping and of short weight in the packs. Although only a limited proportion of the strawberry crop has come under the Scheme this year, there is every reason to anticipate more widespread support by the growers with increasing quantities packed under National Mark labels in future seasons.

National Mark Cherries.—The National Mark Cherries Scheme, as is the case with the Strawberries Scheme, is experimental for its present first season. The number of growers authorized to pack cherries under the Mark this year is not likely to be large, as, although growers generally are interested, there are many whose conversion to the need of reform will be a matter of time.

The following is the first list of authorized packers in the Scheme :—

Kent—
J. L. Barton, Broadwater, East Malling
H. Harvey, Bockingfold, Goudhurst
R. D. Mitchell, Pelican Farm, Wateringbury

Kent—
Mitchell & Wilson, Foxbury Stone St., Sevenoaks
F. I. Neame, The Offices, Macknade, Faversham.
Capt. R. A. Norton, R.N., J.P., Downs House, Yalding

Worcs.—
J. H. Crane, Oakhampton, Stourport.

Kent—
P. N. Wright, North Court, Chilham.
E. J. Colthup, Howletts, Chilham.
F. & T. Neame, Macknade, Faversham.

National Mark Canned Fruit, Peas and Beans.—The canning of home-grown fruit under the National Mark commenced with great vigour with the advent of the first supplies of new season's strawberries. Canning of gooseberries and peas quickly followed. To meet the needs of authorized canners, over 3½ million official National Mark labels were distributed before the end of June. A number of canners have also availed themselves of the alternative method of applying the National Mark, *i.e.*, by incorporating the National Mark design, under licence from the Minister, in their own private brand labels.

Certificates of Authorization to apply the National Mark to cans of home-grown fruit, peas and beans in accordance with the conditions set out below have been issued, on the recommendation of the National Mark Canned Fruit Trade Committee, to the following firms :—

London—
Co-operative Wholesale Society, Ltd., Acton, W.3.
Kearley & Tonge, Ltd., Mitre Square, E.C. 3.

Berkshire—
Co-operative Wholesale Society, Ltd., Coley, Reading.

Cambridge—
Wisbech Produce Canners, Ltd., Lynn Road, Wisbech.

Hampshire—
The Hampshire Preserving Co., Romsey.
J. Long, Ltd., Whitchurch.

Hereford—
Herefordshire Fruit Co., Ltd., Mansion House, Hereford.

Lancashire—
Co-operative Wholesale Society, Ltd., Middleton Junction.

Suffolk—
Woodbridge Canning Co., Ltd., Woodbridge.

Surrey—
J. E. Austin & Co., Ltd., St. James' Works, Cromwell Road, Kingston-on-Thames.

Warwick—

Greenwood, Paige & Co., Ltd., Seville Works, Tyburn, near Birmingham.

Worcester—

Berrow Fruit, Martley.
Harry Phipps, Wyre Hill, Pershore.
Wisbech Produce Canners, Ltd., Evesham.
Vale of Evesham Fruit Canners, Ltd., Badsey, near Evesham.

Yorkshire—

Co-operative Wholesale Society, Ltd., Cumberland Street, Hull.

The following are the conditions applicable to the authorization of canners under the scheme :—

(1) The National Mark may only be applied to cans containing fruit, peas and beans grown and canned in England and Wales, and of the following varieties :—

Plums ..	Victoria, Yellow Pershore, Gisborne, Greengage, Prune Damson.
Apples ..	Bramley Seedling.
Peas ..	Alaska, Goutia Blanc, Bountiful, Advance, Lincoln, Gradus, Prince of Wales, Yorkshire Hero, Green Admiral, Surprise, Delicatesse, Horsford Market Garden.
Gooseberries Strawberries Loganberries Raspberries Blackcurrants Beans	Any variety.

(2) The quality of the contents of each can of fruit, peas or beans to which the National Mark is applied must conform to the statutory definition set out in the Agricultural Produce (Grading and Marking) (Canned Fruits, Peas and Beans) Regulations, 1930 (see also Appendix I of Marketing Leaflet No. 20, issued by the Ministry of Agriculture and Fisheries) according to the grade designation appearing on the label.

A private brand label (whether the property of the authorized canner or of any other person) upon any can to which the National Mark is applied shall, unless permission to the contrary is granted by the Ministry, state clearly the statutory grade designation of the contents.

(3) Each can to which the National Mark is applied must be filled with fruit, peas or beans. In the case of apples, the National Mark shall only be applied to cans of one gallon capacity. Authorized canners shall supply to the Ministry a list of the distinctive lid marks that they propose to apply to cans of fruit, peas or beans canned by them for packing under the National Mark, and each can to which the National Mark is applied shall bear the appropriate lid marks of the authorized canner concerned.

(4) The National Mark shall be applied only by the authorized canner who has canned the fruit, peas or beans, as the case may be. Except where special authority has been granted by the terms of Condition 6 below, the National Mark may only be applied by means of the official National Mark labels which are issued to authorized canners on payment by or on behalf of the Ministry of Agriculture and Fisheries.

(5) Official National Mark labels are not transferable and must be kept in safe custody, all precautions being taken by the authorized canner to prevent their application by unauthorized persons. The National Mark may only be applied at the authorized premises as described in the Certificate of Authorization issued by the National Mark Committee.

(6) The authorized canner, or his printer, may be licensed by the Ministry to incorporate the National Mark design in the design of private brand labels, in a manner approved by the Ministry, for application to cans of fruit, peas and beans as a method of applying the National Mark in lieu of the application of the official National Mark labels.

(7) The authorized canner must keep, to the satisfaction of the Ministry, a record showing the daily receipts, and sources whence obtained, of fruit, peas and beans canned under the National Mark. Where such fruit, peas or beans are not purchased directly from the grower, the authorized canner must obtain from the seller an express guarantee that the fruit, peas or beans were grown in England and Wales, together with an undertaking to submit, if required, proof of origin.

(8) The authorized canner must allow his canning premises and all equipment, stocks and records to be inspected at any reasonable time by any officer of the Ministry of Agriculture and Fisheries authorized in that behalf, and, if so required, must allow any such officer to take samples of fruit, peas and beans going forward to be canned, to be present when National Mark fruit, peas or beans are being canned, and to inspect at any reasonable time and place and to draw samples from National Mark canned fruit, peas or beans packed ready for sale.

(9) The authorized canner must allow any officer of the Ministry of Agriculture and Fisheries authorized in that behalf to remove the National Mark label from any can of fruit, peas or beans which at the time of inspection by such officer—

(*a*) is in the possession of the authorized canner or of the market agent to whom the produce was despatched by the authorized canner for sale, and

(*b*) does not in his opinion comply with the definition of the statutory grade designation appearing on the National Mark label.

(10) If so required by the Ministry, the authorized canner must join any association or federation of canners of National Mark canned fruit, peas and beans which, with the Ministry's approval, may be established by such canners for the purpose of improving the trade in National Mark canned products.

National Mark Wheat Flour.—In the issue of the JOURNAL for May, 1930, mention was made of a London baker who was then selling 2,000 loaves per week made wholly from National Mark All-English (Yeoman) flour. This baker has now increased his weekly output of this class of bread to 4,000 loaves of excellent appearance and flavour. He attributes his success to the development, after careful experiment, of a baking process which ensures uniformly reliable results. Other firms have also reported sales of All-English bread in weekly quantities reaching four figures. These results may be taken as indicating that progress is being made towards standardization of the quality of All-English (Yeoman) flour under the National Mark scheme.

An extended trial of All-English (Yeoman) flour for bread-making has also been made at the Evan Fraser Hospital, under the direction of the Hull Corporation. The results are described as uniformly satisfactory, and the experiment will probably lead to the supply of similar bread to other institutions under the jurisdiction of the Corporation. The rich flavour and satisfying quality of bread made from the product of the finest home-grown wheats are exceedingly attractive and come as a revelation to most people who have been accustomed to eat ordinary bread. The treatment of All-English flour for bread-making may occasion some difficulty at first, but, as was remarked at a recent meeting of the National Mark Wheat Flour Trade Committee, there is no reason why this difficulty should be less successfully overcome than it has been in France, where bread made exclusively from soft native wheats is universally consumed and held in high regard.

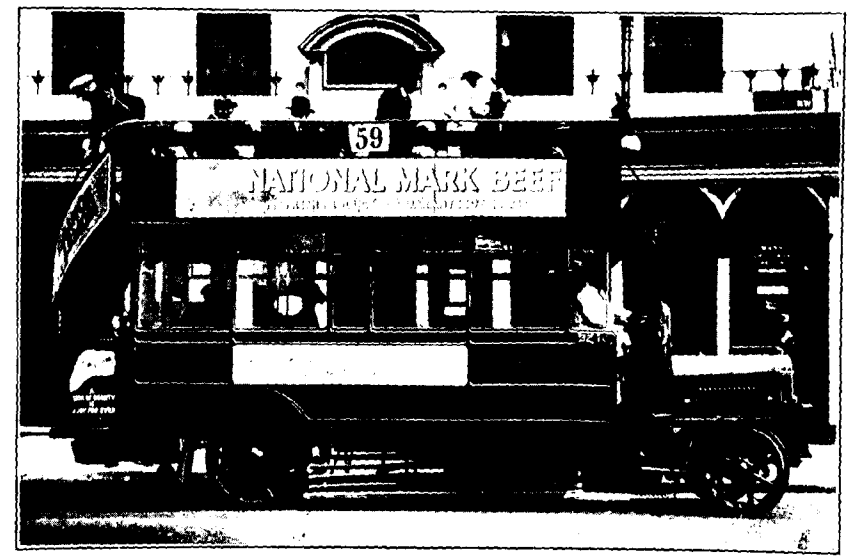
Publicity for National Mark Produce.—In last month's issue of the JOURNAL, reference was made to the Ministry's efforts to increase, by means of advertising and other propaganda, the public appreciation of National Mark produce, and mention was made of the arrangements for advertising National Mark eggs, tomatoes, cucumbers and beef on London omnibuses. Photographs of two of these advertisements are here reproduced. The advertisements were quite attractive, and, while it is difficult to estimate results, the steady demand for beef which, in spite of the hot weather in London, was recorded during the period when the advertisements were displayed may be attributed, in some measure, to the effect of the beef advertisement.

National Mark Weeks have now been held this summer at Torquay, Worcester, Burton-upon-Trent, Hastings, Hull, Folkestone, Leamington Spa, Coventry, Tunbridge Wells and London (Crystal Palace district, eggs only), and displays of National Mark produce have also been staged at other centres where local exhibitions have provided opportunities.

At Birmingham, the Ministry is regularly advertising National Mark beef, in the newspapers and in other ways, in order to develop a strong public demand for this beef in face of the opposition which is being shown by certain trade interests in that City.

Displays of Home Produce.—Home produce was displayed at the following Exhibitions during July :—

Aldershot Command Horse Show—July 2–5.
Colchester Empire Exhibition—July 4–10.



Publicity for National Mark Produce: Two examples of advertising on London omnibuses.

MARKETING NOTES.

To face page 486.

Marketing Demonstrations.—Marketing demonstrations were staged during July as follows :—

R.A.S.E. Show at Manchester	July 8–12	National Mark Hall, Pigs, Cereals, Cheese, and Cinema Hall.
Yorkshire Show at Hull ..	July 16–18	National Mark Hall.
Royal Welsh Show at Caernarvon	July 23–25	National Mark Hall, Pigs and Cereals.
World's Poultry Congress at the Crystal Palace, London ..	July 22–30	Eggs and Poultry.

The Cinema Hall at the Royal Show was a new feature of the Ministry's marketing demonstrations. Films were exhibited showing the preparation and marketing of National Mark eggs, tomatoes and cucumbers, strawberries, canned peas and raspberries, and Cornish broccoli for export. There was also shown an amusing, but instructive, cartoon-film entitled : " The House that John Built," this film being loaned by the Empire Marketing Board.

The following is from the *Manchester Guardian* of July 10, 1930 :—

> " Marketing, good marketing, and the fundamental economy and profit which lies behind good marketing, is the essence of the Ministry of Agriculture's huge pavilion dealing with the National Mark. At one and the same time it tells the farmer what the public wants, and tells the public what excellent produce the National Mark guarantees to them for their money. Wheat growing, grading and marketing in large quantities—an important contribution to solving existing wheat-growing difficulties—are demonstrated brightly, and the excellence of the All-English loaf is emphasized.
>
> " All the many articles of home produce now sold under the National Mark are shown, not only in glass cases, but also in a kinema where it is seen in preparation for the market. The National Mark Pavilion is excellent publicity, but it is also a place where any farmer could spend an hour and carry something useful away with him regarding some of his produce—meat, wheat, milk in cheese, eggs, or fruit."

Travelling Scholarships for Grocer Students.—Last year, as an experiment, and in order to emphasize to an important section of the distributive trade the superlative quality of home produce and bring retailers in touch with new schemes of grading, packing and marketing, the Ministry, in collaboration with the Institute of Certificated Grocers, arranged a tour

in England for students who took the highest places in the Institute's final examination. The experiment proved a success, and, accordingly, at the wish of the Institute, another tour on similar lines was arranged this year.

Early on Monday morning, July 7, Sir Charles J. Howell Thomas, Secretary to the Ministry, accompanied by Mr. A. W. Street, Assistant Secretary, welcomed at the Ministry a party which included seventeen students (two of whom were Scottish) and six officials of the Institute. After congratulating the students on their attainments, Sir Charles explained briefly the purposes for which the tour had been promoted, and wished the party an enjoyable and instructive experience. Mr. W. G. Copsey, Organizing Secretary of the Institute, expressed the party's appreciation of the Ministry's arrangements and referred to the highly educational character of last year's tour.

The party then left by motor-coach for Reading to inspect the biscuit factory of Messrs. Huntley and Palmer. Thence they proceeded to Alresford to see the apiaries and honey-stores of Messrs. John Mavie and Company; to Wootton Bassett to inspect the milk-powder factory of the Wilts United Dairies, Ltd.; to visit en route a typical cheddar-cheese producing farm; and to Calne to be shown the bacon-curing factories of Messrs. Harris. Before leaving Wiltshire, a visit was made to the condensed-milk factory of the United Dairies at Melksham, and the journey was then continued to Cheltenham, where the National Mark egg packing station of the Gloucestershire Marketing Society was inspected, and to Hereford to see Messrs. Bulmer's Cider Works. At Campden (Gloucestershire) the Fruit and Vegetable Preservation Research Station (a department of the University of Bristol) was visited; at Brierley Hill (Staffordshire) the bacon factory of Messrs. Marsh and Baxter; and at Whitchurch (Shropshire) the crustless-cheese establishment of the Glendale Dairy Company, Ltd. At the Cheshire School of Agriculture the application of science to cheese-making was explained, and at Manchester the provision warehouses of Messrs. Seymour Mead and Company were visited. While at Manchester, a day was spent at the Royal Show, where marketing demonstrations of pigs, cereals and cheese, as well as a comprehensive exhibit of National Mark products, were being staged by the Ministry. During the homeward journey the party saw Stilton cheese-making by the farmers' co-operative society at Colston Bassett; potato grading and packing by the Linco Packet Potato

Company at Spalding; fruit and vegetable canning by the Wisbech Produce Canners; the cider-plant of Messrs. Gaymer at Attleborough; the Plant Breeding Institute at Cambridge; the various enterprises of Messrs. Chivers at Histon; and the flour and malt businesses of Messrs. Paine at St. Neots. On returning to London, a visit was made to the Trinity Warehouse of Messrs. Williamsons, Ltd., a multiple-shop organization that handles large quantities of National Mark eggs.

The tour concluded on July 16 with a dinner at the Holborn Restaurant given by the National Farmers' Union.

Proposed Compulsory Wheat Pool for Saskatchewan.—An official statement issued by the Saskatchewan Wheat Pool on June 16 outlines a proposal with regard to pooling legislation which received favourable consideration from the 160 delegates who had been attending the semi-annual session there. This proposal involves a request to the Provincial Government for the passage of a grain marketing act under which all grain grown in the province shall be marketed through a pool; and the presentation of this request to the Government is contingent upon a majority vote of present Wheat Pool members being secured in favour of such legislation, by means of a special ballot of Saskatchewan Wheat Pool contract signers to be mailed to pool members not later than August 1. The official statement follows:—

> "During the past three years, the matter of legislation which would require that all grain grown in the Province be marketed through a pool has been more or less before the membership of this organization. At each of the last six meetings of the Delegate body in Saskatchewan, the matter of legislative pooling has received consideration. Different plans have been recommended from time to time, but until the semi-annual meeting of delegates just concluded, no recommended plan had received the required two-thirds vote of Pool Delegates, who are the legal governing body of Saskatchewan Co-operative Wheat Producers, Limited.
>
> "Much discussion has taken place among bodies of contract signers with reference to the general questions involved, and, finally, the matter was definitely crystallized last week by means of a memorandum submitted by the Board of Directors, in which certain essential points were presented in the form of questions, the answers to which would establish a clear-cut decision and a pool policy on the matter.

"As a result of the discussion which ensued, the Delegate body gave a definite approval to a proposal involving the following principles :—

"1. A grain marketing act under which all of the grain grown in Saskatchewan shall be marketed through a pool.

"2. A submission of the proposal to the contract signers of the Saskatchewan Wheat Pool and a majority opinion in favour thereof of those voting to be secured before a request is made to the Provincial Government for such legislation ; and such majority of opinion, if secured, to be considered as a sufficient mandate from the contract signers on which to approach the Government with a view to securing the necessary legislation.

"3. The proposed grain marketing act when passed to become operative only after a referendum has been taken of all grain producers in the Province and a two-thirds majority vote of those voting secured in favour thereof.

"4. The grain pool, to be provided for under the grain marketing act when passed and approved by the growers of the province, to be entirely grower-controlled.

"5. The control of the pool established under a grain marketing act to be equally divided among all the producers of grain in the province.

"6. The grain marketing act to provide for a legislative pool to be in existence for a period of five years, at the end of which time the Government shall conduct a further referendum on the petition of a certain proportion of growers of grain (to be subsequently decided upon) ; and that, in the event of the growers voting on such referendum failing to support the continuance of the legislative pool, the legislation to continue in effect for one year after the vote to rescind is recorded."

British Columbia Milk Inquiry Commission.—The report of the British Columbia Milk Inquiry Commission, 1928, is an attempt to solve the problem of equalising the burden of "surplus milk" over the whole of the potential suppliers of a given fluid milk market.

The Commission was set up on a recommendation of the

Select Standing Committee on Agriculture of the British Columbia Legislature, the recommendation being embodied in the report of that Committee on the Bill for the Relief of Dairy-farmers introduced in 1927. It was constituted for the purpose of making an independent investigation into the matters involved in that Bill.

An important section of the milk industry in British Columbia is concentrated in the Lower Fraser Valley up to a distance of about 40 miles east of Vancouver City, which forms the principal market for fluid milk. A large proportion of the milk supply of the area is marketed through a producers' co-operative marketing society—the Fraser Valley Milk Producers' Association—which, besides distributing milk, both wholesale and retail, in Vancouver, maintains conversion plants for the manufacture of butter, condensed milk, cheese, milk powder and casein. The Commission found that only 40 to 45 per cent. of the Association's supplies were sold for liquid consumption, while the proportion of the supplies received by independent distributors and sold as fluid milk was considerably higher. The Association was thus largely shouldering the burden of converting surplus milk and non-members were in consequence receiving prices some 10 per cent. higher than those received by members of the Association. The basis of payment for milk by the Association was that of a pooled price f.o.b. Vancouver per lb. of butter fat for all milk of a quality suitable for the fluid milk market, whether the milk actually went into liquid consumption or not.

The Commission made a number of recommendations embodying the following principles :—

(1) The supply of milk and cream for the fluid market is a public service, and though not recommending at the present time municipal ownership or operation of any part of the producing or distributing systems, the Commission consider that the State should exercise authority as an impartial referee in the interests of the producer, the distributor and the consumer.

(2) Efficiency in production and marketing may be best encouraged by "regulated competition."

(3) Except in so far as a more uniform seasonal production should be encouraged by penalising each producer for surplus production above a basic winter quantity, the advantages and disadvantages of the fluid milk market and the lower priced world market for milk

products respectively should be equalized for all producers whose milk is of a quality suitable for the fluid market, and who are potential suppliers of fluid milk. The distance from or proximity to the milk consuming area should not be regarded as affecting the responsibility of any producer, who can supply that area, in respect of the burden of manufacturing milk.

(4) The duplication of delivery services should be reduced as far as possible.

(5) The direct participation of producers in marketing milk is desirable from the point of view both of the producer and of the consumer, since the object of a producers' co-operative society is to stimulate consumption by efficient service.

For the purpose of putting these principles into effect, the Commission recommended the establishment by legislation of a Committee of Direction for the dairy industry—a regulatory body not undertaking any merchanting functions, but making regulations with regard to the production, distribution and sale of fluid milk and cream, on the recommendation of an Advisory Committee comprising representatives of producers and distributors (in each case both co-operative and independent), producer-retailers and consumers. The Committee should be financed by a levy at a rate per lb. on all milk fat entering into trade, subject to the exemption from time to time of any portion of the milk fat. The Commission recommend that producer-retailers should be exempted from the levy, but should be subject to a licence fee per cow.

The two principal functions which the Commission recommended should be performed by the proposed Committee were :—

(1) The pooling of producers' milk prices throughout the area of its operation.

(2) The fixing of retail milk prices on the basis of fat content.

The Dairy Produce Sales Adjustment Act subsequently passed by the British Columbia Legislature in 1929 gave effect to the general principle of equal distribution of the lower prices realized for milk products by means of a Regulatory Board or Committee of the kind recommended by the Commission. The Act, however, specifically excluded the fixing of prices from the Committee's functions.

AGRICULTURAL ACCOUNTING IN WILTSHIRE

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THE Wiltshire Agricultural Accounting Society, which now has 80 members, was founded, in August, 1925, by a few Wiltshire farmers, with the object of establishing some organization which would enable those farming in the county to compare and discuss problems of economic interest, and especially to help one another by making available for each and all an analysis of their farm accounts. This, indeed, has proved itself to be the most valuable side of the society's activities. With the aid of the Department of Agriculture (Economics Branch) of the University of Bristol, the members receive individually an analysis and report concerning their own particular farm, together with annual comparative statistics relating to the members as a whole. There are now four years' accounts available (1925-28), but changes in membership during these four years, through additions and withdrawals, make it possible only to compare results for the whole period in the case of 25 farms. Four years' results from the same 25 farms appeared to be of more value than results from a larger number of farms for a smaller number of years, or, on the other hand, from different farms in each year. By this method, one of the disturbing factors, namely, the management, would be stabilized when comparison is made between the years. In other words, the sample of farms, upon which this report is based, remains the same for the period under consideration.

Size and Type.—These 25 farms have an average size of 1,094 acres, which is divided as follows :—

Arable	37 per cent.
Permanent pasture	32 ,, ,,
Enclosed down	21 ,, ,,
Unenclosed down	10 ,, ,,

With the exception of one farm producing nothing but milk they may be regarded as mixed farms.

Livestock Carried.—On the average of the four years, these farms carried the following livestock per 100 acres :—

1⅔	Horses
14	Cattle*
54	Sheep
2⅔	Pigs

*The word cattle in this article includes dairy cows.

Reducing these varied types of livestock to the equivalent of sheep (by using arbitrary factors) then the land has been carrying 1¼ sheep equivalents to the acre; or, to put it in another way, 1 cattle unit has required 3 acres. Since the proportion of grass is roughly ⅔ of the total farm area, one may say that approximately there have been 2 sheep units to every acre of grassland, or one cattle unit has required 2 acres of grazing.

Tenant's Capital.—The monetary value of tenant's capital has fallen by 15 per cent. over the four years. The average capitalization per 100 acres for the period is as follows :—

	Per 100 acres	Percentage
	£	
Capital in Livestock ..	554	56¾
„ Produce and Tillages ..	279	28¾
„ Implements ..	144	14¾
	977	100

During the four years, the monetary value of livestock fell by 18 per cent., that of produce and tillages by 15 per cent., and implements by 6 per cent. An analysis made of the capital invested in different classes of livestock showed that over the period the greatest decline was in sheep, which fell from £240 (1925) to £155 (1928) per 100 acres. The relative importance of cattle seems to have increased, while that of pigs has remained about constant. Only about $\frac{1}{10}$ of the capital invested in livestock is accounted for by pigs.

Distribution of Capital according to percentage of Permanent Grass.—A classification of the farms according to their proportion of permanent grassland, including downland, throws into relief the way in which the investment of capital per acre decreases from the mainly arable to the mainly grass farms. The figures are the average of the four years.

	No. of farms	Average acreage	Total capital per acre				Capital invested per acre in								
							Live-stock			Produce and Tillages			Imple-ments		
			£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
0— 30% Grass	3	800	11	12	0	6	4	9	3	14	5	1	12	10
31— 70% „	13	1,116	10	8	5	5	8	3	3	10	2	1	10	0
71—100% „	9	1,127	8	6	2	5	11	2	1	10	0	1	5	0

These figures must be read with certain mental reservations, due to the fact that the total number of farms under con-

sideration is small and that the numbers of farms in each group are widely different.

Output.—On the average of the four years these 25 farms gave the following output :—

	Total	Average Output Per 100 acres	Percentage
	£	£	
Cattle	9,504	35	5·7
Milk	72,069	266	43·2
Sheep	28,556	105	17·1
Pigs	5,373	20	3·2
Total Livestock ..	115,502	426	69·2
Crops	44,675	164	26·7
Sundries	6,741	25	4·1
Total Production..	£166,918	615	100·0

In 1925, the output per 100 acres amounted to £643; in 1926, £600; in 1927, £577; in 1928, £637. It was found upon examination of data, not given here, that during the four years there was a tendency for the proportion of the total output taken by livestock to rise slightly at the expense of cereals.

Output and Proportion of Grass.—An attempt was made to ascertain whether, taking the average of the 4 years, there was any connexion between the proportion of grass on the farm and the value of the output. The following are the figures :—

		Average output per 100 acres
0— 30 per cent. grass	3 farms	£655
31— 70 „ „	13 „	£663
71—100 „ „	9 „	£550

In the last group of 9 farms there are 2 farms each below 100 acres, and if these be omitted then the other 7 give an average output of £538.

Turnover of Capital.—The 25 farms, on the average of the 4 years, show a fairly low capital turnover. In the first 3 years the output was equivalent to ⅔ of the capital; in 1928 it was ⅗. Only one farm turned over its capital on the average of the period more than once. This farm was one of the two which were under 100 acres.

Costs of Production.—On the average of the period, the total costs of production absorbed 97·3 per cent. of the total output, the figures being £162,403 and £166,918 respectively. In a bad season like 1927 the effect was to send the costs up to 5½ per cent. more than the total output. Of these total

costs, 68·7 per cent. was absorbed by prime and 31·3 per cent. by overhead costs. It has been found by analysis that, in spite of the varying seasons, the costs remained remarkably steady, but that there was a greater margin between costs and output in the group of mainly grass farms. The three arable farms found that their costs were greater than their output by 2 per cent.

(a) *Cost of Labour.*—On the average of the period, the labour bill absorbed 32 per cent. of the total farm costs. A comparison of the labour cost according to the proportion of grassland gives the following information :—

Grass	Farms	Labour per 100 acres	Labour as percentage of output	Amount of output per £100 of labour
0— 30 per cent.	3	£228	33·6	£298
31— 70 ,,	13	£203	30·7	£326
71—100 ,,	9	£233	29·0	£345
or omitting the two small farms in the last group the results are				
71—100 per cent.	7	£148	25·7	£390

The table shows that (omitting the 2 small holdings) the labour bill per 100 acres is heaviest on the arable and lightest on the mainly-grass farm. In other words, for every £1 spent in wages the arable farm obtains an output of not quite £3, while the grass farm obtains nearly £4.

(b) *Feeding Stuffs.*—The bill for feeding stuffs is often almost as large as that for wages. On the average of the 4 years, these farms spent £1 11s. 0d. per acre, or something more than $\frac{1}{3}$ of the value of the output of livestock, which amounted to £4 3s. 7d. per acre. For every £1 spent on purchased foods the average output of livestock amounted to £2 13s. 7d.

(c) *Purchased Seeds and Manures.*—This item only accounts for $\frac{1}{25}$ of the total farm expenditure or 5s. per acre.

(d) *Rent.*—The average rental has fallen from 14s. 7d. in 1925 to 14s. 2d. per acre in 1928. On the average, this item accounts for about $\frac{1}{5}$ of the total expenditure. It was found that the 13 mixed farms had the heaviest rental, at 15s. 10d. per acre, the 3 arable farms were lowest at 12s. 7d., and the 7 mainly grass farms (omitting 2 small holdings) carried a rent of 13s. 7d. per acre. Although the number of farms in each group is small, one is led to ask whether these rentals indicate a greater demand for mixed as compared with arable or grass farms.

(e) *Other Items* (*Maintenance Costs*).—Under this heading comes expenditure upon many miscellaneous items, and

although the individual disbursements are usually small, yet when totalled at the end of the year they amount to a considerable sum. On these 25 farms, it was found that the average cost of these items amounted to £1 1s. 0d. per acre or approximately to $1\frac{1}{2}$ times the rent, and absorbed $\frac{1}{6}$ of the total production.

Net Profit.—The following table gives particulars of the profits and losses of 4 years of farming :—

25 FARMS

Year	Total profit £	Return on capital Per cent.	Profit per 100 acres £	Profit per acre s. d.
1925	10,172	3·5	37·6	7 6
1926	3,948	1·4	14·6	2 11
1927	−8,828*	−3·5*	−32·4*	−6 6*
1928	12,753	5·5	46·6	9 4
Average	4,511	1·7	16·6	3 4

* Loss.

The net result of four years of farming is therefore only $1\frac{3}{4}$ per cent. on the capital invested. Since interest on capital is not included before arriving at the profits it means that 3s. 4d. per acre is all that the farmer has to meet interest on capital and earnings of management. In 1927, the result was an average loss on all farms of 6s. 6d. per acre. In that year the three arable farms together lost £2,218, the 13 mixed farms lost £4,612 and the 9 mainly grass farms lost £1,998. The net result of the four years was that the 3 arable farms lost £1,535 ; they made profits in 1925 and 1928, but lost in the other 2 years. The 13 mixed farms made profits in 3 years, the net result of the 4 years being a profit of 4s. 5d. per acre as compared with the loss of 3s. 5d. per acre on the 3 arable farms. The 7 mainly grass farms, omitting the 2 small holdings, also made profits in 3 years and finished up with an average profit of 4s. 7d. per acre. Thus, whether these results be regarded from the point of view of profits per acre or of return on capital, the mainly grass farm came off best. The results are summarized in the table overleaf (page 498).

It may be stated here that the reason for excluding or including the 2 small holdings is that they have both lost very heavily during the four years and they are unduly small in acreage as compared with the other 23 farms.

Conclusion.—This statement is a résumé of a much more detailed report published by Bristol University as a separate

Grass	No. of farms	Net result of four years	Average per year	Percentage on capital	Per 100 acres	Per acre
					£	s. d.
0— 30 per cent. ..	3	−£1,535	−£384	−1·45	−17·1	−3 5
31— 70 „ ..	13	+13,174	+3,293	+2·10	+21·9	+4 5
71—100 „ ..	7	+ 8,766	+2,192	+2·25	+22·8	+4 7
including 2 small holdings :—						
71—100 „ ..	9	+ 6,406	+1,602	+1·93	+16·2	+3 3

pamphlet. The results are based on an admittedly small number of farms, but since no effort has been made to select them in any way, it is felt that results from a larger number of farms would probably follow the same direction. In fact, since the men, whose farms are considered in this report, are acknowledged to be some of the best farmers in Wiltshire, a larger sample of farms would possibly give somewhat worse financial results.

* * * * * *

AUGUST ON THE FARM

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Arable Crops.—In the southern counties this is the great harvest month. Autumn-sown grain crops are usually cut in July; spring-sown crops may not be fit until well into this month. Up to the time of writing, the season has been favourable to the growth of grain crops and if everything associated with the industry were as satisfactory as the crops of hay and grain, agriculture would be prosperous indeed. The close of the harvest is not a period for the cessation of activities; indeed, the more successful the farmer the greater is the hustle to prepare for the following crops.

In the southern counties an endeavour is made to sow as much as possible of the cereal area during the autumn months. An early harvest is a considerable advantage and allows more time for cultivation. Where one cereal crop is to follow another the stubble should be broken up as it is available in order to clear off perennial weeds and to encourage the germination of annual weeds and any grain which has been shed during harvest. Steam tackle is very suitable for this class of work. The tractor also can do excellent work; at no time of the year can it be used to better advantage. Dry conditions are desirable; but the hard ground entails a greater expenditure in shares and cultivator points.

Stubble land which is destined for a complete bare fallow in the following year need not be broken up immediately after harvest; work should be concentrated on land to be sown with cereals or catch crops. Land that is reasonably clean and is to grow roots in the following year can be sown with catch crops. Stubble that has been broken up early may grow white turnips successfully. The main catch crops are mixtures of cereals and tares suitable for sheep feeding. A small portion may be sown with crimson clover, commonly called trifolium. This is a bulky forage crop and the preparation of the land is easy and cheap; it is not advisable to plough, but the land may be given merely a good surface harrowing, after which the seed may be sown and be firmly rolled in. Such a practice, however, makes the trifolium stubble very difficult to deal with in the following year, and in part accounts for the gradually diminishing area now devoted to this crop.

Systems of Farming.—The cropping of the arable land is a matter to be settled by individual farmers according to the condition of the soil and the system of farming. Knowledge of the manurial requirements of individual crops and of the improved methods of tillage now available gives farmers an opportunity of varying the cropping without necessarily reducing the fertility of the land. The difficulty at the moment is not to know what manures to use and what tillages to adopt in order to grow a full crop, but to decide what crops shall be grown.

Mixed farms may grow crops which can be utilized by the stock in conjunction with the grass land, and so substitute home-grown produce for much, if not all, of the purchased foods. Oats will often be given preference because of their usefulness for many classes of farm stock.

Farms which are mainly arable have a more difficult decision to make. Crops which can be sold are a necessity. In many cases the farms are not sufficiently well equipped with buildings, water supplies and fences to enable them to be easily converted into stock farms, and though facilities for keeping stock during the winter may be available there are few cases where the whole of the produce could be profitably utilized in this way.

Potatoes are a crop that one dare hardly mention to those who have cultivated any considerable acreage during the past two years; this country can, and does, produce more potatoes than can be marketed for human consumption, and the crop

is and will continue to be an important feature in the agriculture of this country. A restriction of the acreage, or a reduction in the yield per acre, or an increased consumption would soon restore this crop to profitable cultivation. The disparity in price between good, sound, well-matured potatoes of the 1929 crop and the new immature imported potatoes of the 1930 crop, which was so annoying to the growers of English potatoes in the early summer, should not be overlooked. It may be asked whether the trend of potato growing in this country is in the right direction. Nothing has been more noticeable in recent years than the increased area devoted to heavy-yielding varieties. These varieties are not always those most in demand by the consumer, which he will purchase more freely, and for which he is prepared to pay the highest price. It is possible that a variety like Golden Wonder might have increased the consumption of home-grown potatoes and lessened the difference between the price of the old crop and the early imported article.

The grower of sugar beet has again come to a stage when he is faced with uncertainty. For a number of years he has been in the happy position of knowing before he prepared for the crop what price he would obtain, and he had a certain knowledge that the whole of the crop would find a market. If new conditions to be arranged for the next three years are such as to reduce substantially the area at present devoted to the crop the difficulties of the arable farmer will be materially increased, unless markets for cereals become much more favourable. If sugar beet is to be grown there should be no delay in making early preparations for the crop; early breaking of the stubble and the application of well-rotted farmyard manure are not the least important factors in ensuring a good crop. The economic situation of the arable farmer is difficult, but if arable crops are to be grown the importance of good tillage and suitable manuring is undiminished. It is certain that if full crops do not pay, half crops will be worse. Half crops give opportunities to weeds, which in turn mean more cultivations or further decreases in yield.

There are few farmers who really desire to reduce their arable area and to lay the land down to grass. It is not the desire of the farmer, but the overpowering force of economic necessity which is converting arable land into grass land. There is no necessity to have a greater area of grass land in this country. Much of the grass land which now exists is underfarmed and understocked, and the knowledge and means

of improving that grass land are available and would be applied if there was a profitable means of utilizing the produce. The expansion of the grass land area which was such a notable feature of the last 20 years of the nineteenth century may have been the effect of economic necessity, but the greater demand for milk and milk products was a compensating advantage. No such advantage is apparent at the present time. The demand for liquid milk is more than met. Improved transport facilities have brought liquid milk from farms and districts which formerly reared stock or made butter or cheese. The change from butter-making to the sale of liquid milk is easily understood. The varied quality of farmhouse butter made orderly marketing and sustained demand almost impossible in the face of factory-produced supplies of uniform quality. The decrease in the manufacture of cheese on the farm is to be regretted. Factory made cheese from transported milk, however skilled the management may be, cannot compare in quality with the cheese made on the farm by a reasonably well-skilled cheesemaker.

Cheese-making involves a system of farming which should be encouraged and extended, and every facility should be provided for improving the skill of the cheesemaker and bettering marketing methods. No system of farming lends itself so well to a combination of stock rearing and milk production at a minimum of expense. There is no pressure to maintain a definite quantity of milk from day to day or at different seasons; freedom in this respect obviates the necessity of frequent purchase of milk cows, and a self-contained herd is easier to maintain in a healthy condition. The bulk of the cows calve down in the early spring months at a time when cheap rearing of calves is possible; the main part of the lactation period is during the grazing season, so that a minimum of concentrated foods is required; and whey is available as a valuable food for pigs. There are thus three sources of income intertwined. The maintenance of a herd under such conditions is easier and the life of the individual cow is longer. The sale of a proportion of the cows each year in full profit and without a fault is a common feature on cheese-making farms, but rare on a milk-selling farm where level quantities of milk are aimed at throughout the year.

Sheep.—The line of expansion at the present time is the greater area of grass land, much of it recently laid down, devoted to the feeding of grass sheep. Sheep prices have

remained better and steadier than those of most farm products. Sheep have been a valuable asset to the arable farmer for many years; they manure the land and bring in considerable revenue. Shepherding under arable conditions, however, is expensive, and as there appears to be little chance of materially reducing this expenditure, greater attention is being given to grass sheep.

Land which has been recently laid down to grass provides healthy grazing, and favourable returns may be expected for a number of years. There is considerable diversity of opinion

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended July 16				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) .. *	10 2*d*	10 2*d*	10 2*d*	10 2*d*	13 0
Nitro-chalk (N. 15½%) .. *	9 19*d*	9 19*d*	9 19*d*	9 19*d*	12 10
Sulphate of ammonia :— Neutral (N. 20·6%) .. .. *	10 2*d*	10 2*d*	10 2*d*	10 2*d*	9 10
Calcium cyanamide (N. 20·6%) *	9 6*e*	9 6*e*	9 6*e*	9 6*e*	9 0
Kainit (Pot. 14%) .. .. §	3 6	2 19	2 19	2 18	4 2
Potash salts (Pot. 30%) .. §	5 3	4 18	5 0	4 11	3 0
" (Pot. 20%) .. §	3 15	3 9	3 8	3 6	3 6
Muriate of potash (Pot. 50%) §	9 17	9 3	9 2	8 10	3 5
Sulphate,, " (Pot. 48%) §	11 19	11 6	11 5	10 5	4 3
Basic Slag (P.A. 15¾%)‖ .. §	2 13*c*	2 3*c*	..	2 9*c*	3 1
" (P.A. 14%)‖ .. §	2 7*c*	1 16*c*	1 16*c*	2 3*c*	3 2
" (P.A. 11%)‖ .. §	..	1 9*c*	1 9*c*	..	..
Ground rock phosphate (P.A. 26-27½%)‖ .. .. .. §	2 2*a*	2 10*a*	2 5*a*	2 7*a*	1 9
Superphosphate (S.P.A.16%).. §	3 11	..	3 9	3 6	4 2
" (S.P.A.13¾%).. §	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3¾%, P.A.20½%) §	8 15	8 10	8 7	7 5	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%) .. .. §	5 17*b*	5 15*f*	6 10	4 7	..

Abbreviations: N.=Nitrogen; P.A.=Phosphoric Acid; S.P.A.=Soluble Phosphoric Acid. Pot.=Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 80% through standard sieve. *a* Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

as to the best breed or type for a particular district. The extension is mainly directed towards producing cross-bred lambs. In the southern counties it is possible to find, within a comparatively small radius, representatives of half-a-dozen or more breeds kept as female stock and there is an even greater variety in the breed of ram used. Farmers are feeling their way in this line and hoping for the best. The demand for lamb all the year round necessitates a diversity of methods, in which a place is easily found for a proportion of arable land sheep. Cross-breeding cannot be indefinitely pursued without due regard to the maintenance of pure breeds.

Mr. Alfred Mansell has given a timely warning on this point; nothing could be more unfortunate than that the extension of cross-breeding should lead to the use of indiscriminate crosses as either parent.

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NOTES ON FEEDING STUFFS

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Dairy Heifers.—The cow is the product of two factors—her breeding, and the environment in which she exists. Both of these play a large part in determining her worth, and, as regards the second factor, her treatment up to the time of her entrance into the milking herd is of great importance. By the time of her first calving a heifer has cost her owner much money, so that he will not be disposed to treat her lavishly during this unproductive part of her life: at the same time if he economises too much on her rearing he will regret it later on. It is just one of those questions on which the farmer must trust largely to his own judgment, and there are very few established facts to aid him. It is intended here to mention a few considerations which should be present in his mind when deciding on his policy in the rearing of his heifers. The two chief points which arise are as to how far size is desirable in a dairy cow, and at what age she should calve for the first time. Obviously the two questions are closely connected.

Other things being equal, size is probably desirable in the dairy cow. There are any number of small cows that are good milkers, but there does seem to be a broad rule that the bigger the cow is, the higher will her milk yield be. In general, the

larger of the dairy breeds give the higher yields, but the relation is not very close—in fact, it depends very largely on what breeds are included as the dairy ones. Within the breed it is probable that the rule applies more closely, though very little statistical work has been done on the point. One analysis was carried out with the records of American Advanced Registry Guernseys, and it was found that, after making allowance for age, there was an average increase in yearly yield of 16 lb. of fat for every 100 lb. increase from cow to cow in live weight. An extra 100 lb. in live weight would have a slight effect on the maintenance requirement, but would probably only raise the cost of that part of the ration by about ½d. per day—say 15s. a year: this, and the little extra in the way of production food, is easily covered by the value of 16 lb. of butter fat. Consequently size may be regarded as desirable for its own sake.

When we come down to the actual cow it will be more important, for loss of full inherent size will be synonymous with stunting of growth, which has a harmful effect on yield. Thus the aim should be to develop the heifer fully, while remembering that pushing her ahead by the use of much concentrated food is economically unsound. As in so many other instances a happy medium must be struck, and this can best be done by feeding her chiefly on home-grown foods. Roughages are believed to be particularly desirable, as it is supposed that rearing on the coarser foods helps to develop the intestinal capacity, and so gives the ability to deal with large quantities of food, which, it is hoped, will be necessary to support the anticipated yield. This sounds reasonable and may be accepted until it is disproved, but extremely coarse foods, like straw and very poor hay, are to be avoided, as they are difficult to digest; practically all their nutriment goes to heat, and this means that they will serve for maintenance but not for production. Such foods, therefore, will keep the heifer alive, but will not allow her a chance to grow, however much of them is given. It is this feeding of very coarse foods, rather than starvation, which leads to the stunting of growth which is, unhappily, widespread. A steady increase in live weight of something like 1 lb. a day, or a little under, should be aimed at: more than this is wasteful and expensive, and probably does more harm than good, as it induces too great a putting on of flesh.

The age at which a heifer should calve for the first time is a very vexed question. There is always a sort of struggle going on between the cells of the milk gland and the cells of the

other tissues of the body for the food materials which are carried round by the blood stream. If the gland is not put into action until late in life it may well be that it will be less successful than if it had been competing before the other tissues had so thoroughly established their ascendency. This is pure speculation, but the view receives support from farmers who like heifers to calve early in order to get the "milking habit" into them. It is evident that the earlier a heifer calves the less is her cost up to the time she comes to profit, and consequently the less hangs round her neck in the way of depreciation. On the other hand, early calving will tend to prevent the attainment of full size, which, as discussed above, is desirable. It is not the actual carrying of the calf which stunts her growth, but rather the lactation which follows it. It appears, therefore, that there must be an optimum age for first calving, but the determination of where this lies, by direct experiment, is almost impossible. In some experiments with cows conditions can be changed over with the same animals, and each one can be used as a "control" to herself in studying the effects of those conditions. Nothing of that sort is possible in this case, however, as, once a heifer has calved at two years old, it cannot be ascertained what she would have done if she had been left for another year. Consequently, a series of groups of heifers calving for the first time at different ages is necessary, and each group must contain a large number of animals to ensure that the average ability of the groups is about constant. The cost of such an experiment would be prohibitive, as all animals, good and bad, would have to be kept on for a number of lactations, and few, if any, Institutes have the money, stock, or accommodation for carrying it out.

Inquiry is, therefore, restricted to collecting records from commercial herds and analysing them statistically. Here a great difficulty arises, for few farmers aim to calve heifers at a definite age; in general practice they are put to the bull more according to their size than their age. It is true that the chief consideration is often that of when their milk will be required, but in drawing heifers from a bunch for bulling the tendency is to draw the larger ones rather than the older ones. It follows that if records are collected the early calving heifers will include the best grown ones, whilst the late calvers will include more than their fair share of undergrown animals, so that neither the early nor the late calving groups will be a fair sample of the whole lot—they will be biased in opposite directions.

From this it follows that since size is mixed up with age at

first calving the two things must be studied together. The writer has been collecting records with this end in view for some years, but, with pressure of other work, has found it a slow business. The following preliminary results are based on 84 Shorthorns (Pedigree, Non-Pedigree, and Lincoln Red). The number is small, but appears to be fairly representative, as the average yield in the first lactation was 6,113 lb., which was very close to the figure of 6,100 lb. given by 879 Norfolk heifers. Each of these 84 heifers was measured within six weeks of her first calving, the three measurements taken being the shoulder height, back length, and length of leg. Being definitely bone measurements these are unaffected by the state of fatness, and so serve to give figures for the actual size of the animal, as opposed to her "condition" at the time they were taken.

Dividing the animals into five groups according to age at calving, the following averages were obtained :—

Average Age at First Calving	*Average Yield in First Lactation*
30·2 month	5,987 lb.
33·2 ,,	5,639 lb.
35·1 ,,	6,290 lb.
37·1 ,,	6,208 lb.
42·6 ,,	6,850 lb.

With slight irregularity these figures show a rise in yield with increased age at first calving. On the average that rise is 80 lb. of milk for every month of age. At the same time the older a heifer the larger she is, and it was found that there was also a relation between size and yield. This relationship is most easily described by saying that the yield rose by 67 lb. for every centimetre in shoulder height, 57 lb. for every centimetre in back length, and 75 lb. for every centimetre in leg length (it must be pointed out that a centimetre difference in leg length is fairly considerable, whilst it is only a minor matter with the other two measurements). Part of the rise with age is therefore due to size increase, and part of the rise with size is due to age increase: the two effects can be disentangled and measured separately. For this the shoulder height was taken as the measure for size, and the final result reached was that the first lactation yield was put up by 66 lb. for every month's delay in calving and 51 lb. for every additional centimetre in shoulder height. Thus, both age and size are important, and measuring the effect of one without consideration of the other is unjustified, and liable to lead to erroneous conclusions.

The really important question, however, has not been mentioned: what is wanted is knowledge of how the heifers

will do as they grow older. For the answer to this time must be allowed, as they are still far from mature. The conclusion reached up to this point is that size is definitely desirable, and consequently that fairly generous treatment of young heifers is sound policy, and that the longer the first calving is postponed the higher will be the yield in the first lactation.

The whole problem is very involved, and its final practical decision will be difficult. As a cow's milking life is lamentably short (about three to five years on the average) late calving may be good as ensuring that that period should be when the heifer is nearer her maturity and therefore when she is a higher potential yielder. What effect the time of calving has on her powers of disease resistance we do not know, but it is conceivable that some such point as this may be the deciding factor. Dogmatism would be very premature, but it might be added that the average age at calving for all these 84 heifers was just under 35 months. Drawn, as they are, from a number of different herds, this may be taken as a fairly close approximation to the average age at which Shorthorns in this country do calve. Some generations of experience have led to this, and consequently it may be adopted until it has been shown to be wrong.

From the foregoing considerations, however, a system might be suggested as an alternative and worthy of trial. Heifers might be calved rather earlier, but not served again for some time, and so got into milk whilst still young, but given a chance to make up growth after the first lactation. If this latter is to happen it is essential that they should be dried off in good time in the first lactation (*i.e.*, some time before they are due again) as it will only be the interval between the first and the second lactations which will provide this chance. If they are kept in milk right the way through, delay in service during the first lactation will do no good at all. This system should give good results, but it must be added that some practical men would dislike it on the ground that baulking a heifer by putting off service in the first lactation tends to make her a shy breeder: though it has never been shown that this is so, there is no evidence on which it can be refuted.

* * * * * *

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British..	—	—	8 5	0 12	7 13	72	2 1	1·12	9·6
Barley, British feeding ..	—	—	6 10	0 9	6 1	71	1 8	0·89	6·2
„ Danubian	16 6	400	4 12*	0 9	4 3	71	1 2	0·62	6·2
„ Persian..	16 3	„	4 12	0 9	4 3	71	1 2	0·62	6·2
„ Russian..	17 0	„	4 15	0 9	4 6	71	1 3	0·67	6·2
Oats, English, white	—	—	6 5	0 10	5 15	60	1 11	1·03	7·6
„ „ black and grey	—	—	7 0*	0 10	6 10	60	2 2	1·16	7·6
„ Canadian mixed feed ..	13 9	320	4 17*	0 10	4 7	60	1 5	0·76	7·6
„ Argentine	13 6	„	4 15	0 10	4 5	60	1 5	0·76	7·6
„ Chilian	15 3	„	5 7	0 10	4 17	60	1 7	0·85	7·6
„ German	18 9	„	6 12	0 10	6 2	60	2 0	1·07	7·6
Maize, Argentine	27 6	480	6 8	0 9	5 19	81	1 6	0·80	6·8
„ South African	29 9	„	6 18§	0 9	6 9	81	1 7	0 85	6·8
Beans, Chinese	—	—	9 2§	1 4	7 18	66	2 5	1·29	20
Peas, Japanese	—	—	15 5§	1 1	14 4	69	4 1	2·19	18
Dari	—	—	7 5	0 11	6 14	74	1 10	0·98	7·2
Milling offals—									
Bran, British..	—	—	3 10	1 0	2 10	42	1 2	0·62	10
„ broad	—	—	4 7	1 0	3 7	42	1 7	0.85	10
Middlings, fine, imported ..	—	—	5 2	0 16	4 6	69	1 3	0·67	12
„ coarse, British ..	—	—	4 2	0 16	3 6	58	1 2	0·62	11
Pollards, imported	—	—	4 0	1 0	3 0	60	1 0	0·54	11
Meal, barley	—	—	6 7	0 9	5 18	71	1 8	0·89	6·2
„ maize	—	—	7 5	0 9	6 16	81	1 8	0·89	6·8
„ „ South African ..	—	—	6 7	0 9	5 18	81	1 5	0·76	6·8
„ „ germ	—	—	5 10	0 15	4 15	85	1 1	0·58	10
„ locust bean	—	—	7 5	0 7	6 18	71	1 11	1·03	3·6
„ bean	—	—	10 10	1 4	9 6	66	2 10	1·52	20
„ fish	—	—	18 0	3 1	14 19	53	5 8	3·04	48
Maize, cooked flaked	—	—	8 2	0 9	7 13	83	1 10	0·98	8·6
„ gluten feed	—	—	6 15	0 19	5 16	76	1 6	0·80	19
Linseed cake, English, 12% oil	—	—	10 5	1 8	8 17	74	2 5	1·29	25
„ „ „ 9% „	—	—	9 7	1 8	7 19	74	2 2	1·16	25
„ „ „ 8% „	—	—	9 2	1 8	7 14	74	2 1	1·12	25
Soya bean cake, 5½% oil ..	—	—	8 12*	1 19	6 13	69	1 11	1·03	36
Cottonseed cake—									
English, 4½% oil	—	—	4 17	1 6	3 11	42	1 8	0·89	17
„ „ Egyptian, 4½%„	—	—	4 5	1 6	2 19	42	1 5	,0·76	17
Decorticated cottonseed meal, 7% oil	—	—	10 0*	1 19	8 1	74	2 2	1·16	35
Ground-nut cake, 6-7% oil ..	—	—	6 10†	1 7	5 3	57	1 10	0·98	27
Decorticated ground-nut cake, 6-7% oil	—	—	7 15†	2 0	5 15	73	1 7	0·85	41
Palm kernel cake, 4½-5½% „	—	—	5 15†	0 17	4 18	75	1 4	0·71	17
„ „ „ meal, 4½% „	—	—	6 5†	0 17	5 8	75	1 5	0·76	17
„ „ meal 1-2% oil ..	—	—	5 5†	0 17	4 8	71	1 3	0·67	17
Feeding treacle	—	—	6 7	0 9	5 18	51	2 4	1·25	2·7
Brewers' grains, dried ale ..	—	—	4 7	0 17	3 10	48	1 5	0·76	13
„ „ „ porter	—	—	4 0	0 17	3 3	48	1 4	0·71	13
Malt culms	—	—	6 10§	1 6	5 4	43	2 5	1·29	16

* At Bristol. † At Hull. § At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of June and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £9 per ton, then since its manurial value is 17s. per ton as shown above, the food value per ton is £8 3s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 2s. 2d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·16d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N 9s. 0d.; P_2O_5, 2s 10d.; K_2O, 3s. 4d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (Imported)	71	6·2	4 13
Maize	81	6·8	6 13
Decorticated ground nut cake	73	41·0	7 15
„ cotton cake	71	34·0	9 15

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·43 shillings, and per unit protein equivalent, 2·19 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9·6	6 4
Oats	60	7·6	5 2
Barley	71	6·2	5 15
Potatoes	18	0·6	1 7
Swedes	7	0·7	0 12
Mangolds	7	0·4	0 11
Beans	66	20·0	6 18
Good meadow hay	37	4·6	3 3
Good oat straw	20	0·9	1 11
Good clover hay	38	7·0	3 10
Vetch and Oat silage	13	1·6	1 2
Barley Straw	23	0·7	1 14
Wheat straw	13	0·1	0 19
Bean straw	23	1·7	1 17

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway W.C.2, price 6d. net.

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MISCELLANEOUS NOTES

Importation of American Apples

DURING the autumn of 1929, Inspectors of the Ministry carried out examinations of apples taken from consignments imported from the United States. Some of the samples taken proved to be severely infested by the larvæ of the Apple Fruit Fly, or "Railroad Borer" as it is called in the United States, where it is a dangerous pest in apple orchards. The Apple Fruit Fly is not known to be present in orchards in this country, and in order to guard against its introduction, the Minister has made an Order (The Importation of Raw Apples Order of 1930) which in effect prohibits the entry of low-grade apples from the United States in any year between July 7 and November 15, the period when the pest may be expected to be present in the fruit.

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Young Farmers' Clubs: Report

THE first annual Report, viz., that for 1929–30, of the National Association of Young Farmers' Clubs has just been issued, and reveals that the movement has made good progress since the inauguration of the Association in January, 1929, to which reference was made in the issue of this JOURNAL for that month. Some 20 new clubs have been started and the total club membership has been nearly doubled, the number of clubs now in existence being just under 100, with a membership approaching 2,000. Three County Branches of the Association have been formed. An Association badge has been prepared and issued to over 1,000 members, whilst the monthly illustrated journal of the Association, *The Young Farmer*, has already achieved a circulation of approximately 2,000 copies.

A considerable amount of education and propaganda work has been carried out during the year, about 110 meetings having been addressed in all parts of the country with the result that there is evident throughout the country a general quickening of interest in the movement. Many county agricultural authorities and other educational bodies, recognising the value of the clubs, have expressed their willingness to help, and in several cases have taken definite steps to extend the movement. The activities of the Association have also aroused interest

in the work in Northern Ireland and elsewhere. An official, who has had considerable experience of club work in Buckinghamshire, has spent some time undergoing training in the offices of the Association, and has since been appointed Organizing Secretary for Young Farmers' Clubs in Northern Ireland.

It is emphasized that the future development of the movement depends on the increase in the number of clubs with progressive improvement in the standard of club work, and, in outlining the directions in which this can be achieved, the co-operation is enlisted of all, whether individuals, voluntary organizations or public authorities, interested in rural development and the welfare of young people.

The Report includes a short history of the movement and an account of its aims and ideals, also notes of interest concerning the work of individual clubs, and the national and international cattle judging competitions which are organized in connection with club work.

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The Agricultural Index Number

PRICES of agricultural produce in June were on average 31 per cent. above those ruling in the corresponding month of 1911–13 as compared with 34 per cent. in May and 40 per cent. in June, 1929. Most descriptions of produce contributed to the drop of 3 points on the month, fat pigs especially showing a sharp decline.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	37
May	57	50	42	54	44	34
June	53	48	41	53	40	31
July	49	48	42	45	41	—
August	54	49	42	44	52	—
September	55	55	43	44	52	—
October	53	48	40	39	42	—
November	54	48	37	41	44	—
December	54	46	38	40	43	—

Grain.—Quotations for grain were lower than in the preceding month, the reductions amounting to 3d. per cwt.

in the case of wheat and oats and 6d. for barley. On the June figures, wheat was only 7 per cent. dearer and barley and oats 4 per cent. and 16 per cent. respectively cheaper than pre-war. A year ago prices ranged from 21 per cent. for wheat to 33 per cent. for barley above those ruling in the base years.

Live Stock.—Values for fat cattle receded slightly during the period under review and the index figure fell by 3 points to 27 per cent. above 1911–13. Fat sheep also became a little cheaper, but owing to the fact that a more pronounced decrease occurred in the base period, the index number advanced by 3 points to 66 per cent. in excess of pre-war. Bacon pigs were reduced in price by 1s. 9d. per score lb. and porkers by 2s. and the relative index figures were 15 points lower at 46 and 52 per cent. above the base levels. The June quotations for both dairy cows and store cattle were not as high as in May, but in neither case did the index figure show any change. Store sheep prices also were lower, but on account of the far greater fall which took place in the base years, the index number advanced by 19 points to 65 per cent. over pre-war. Store pigs became appreciably cheaper on the month, but were still about double their pre-war price.

Dairy and Poultry Produce.—Milk was unchanged either in price or index number as compared with a month earlier. With the arrival on the market of new Cheddar cheese, average values for cheese showed a substantial reduction to 42 per cent. above pre-war, while butter also was a little cheaper. Prices of eggs advanced by 1d. per dozen, the index figure being one point higher at 29 per cent., while poultry was rather lower at 57 per cent. above the level of the base years.

Other Commodities.—Following upon the slight recovery between April and May, prices of old potatoes in June fell back somewhat, and the index figure declined by 4 points to 40 per cent. below pre-war. Both clover and meadow hay were reduced in price by about 4s. per ton, and the combined index for hay was 3 points lower at 25 per cent. above 1911–13. Values for wool fell to one point below the pre-war level.

As regards fruit it is noticeable that strawberries so far this year have averaged only 6½d. per lb., as against 9¼d. in June, 1929, the index number showing a drop on the year of 46 points to 8 per cent. above pre-war. Gooseberries also have been appreciably cheaper, but black cherries have sold at about the same prices as a year ago.

Index numbers of different commodities during recent months and in June, 1928 and 1929, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13.

Commodity	1928	1929	1930			
	June.	June.	Mar.	Apl.	May.	June.
Wheat	38	21	12	14	11	7
Barley	46	33	—2*	Nil.	—1*	—4*
Oats..	69	26	—15*	—11*	—11*	—16*
Fat cattle	47	31	37	33	30	27
Fat sheep	83	59	52	56	63	66
Bacon pigs	43	70	90	76	61	46
Pork pigs	38	65	96	80	67	52
Dairy cows..	32	30	30	30	29	29
Store cattle..	26	22	26	24	28	28
Store sheep..	55	65	48	43	46	65
Store pigs	22	77	125	113	108	101
Eggs	38	40	31	40	28	29
Poultry	52	63	52	55	64	57
Milk	53	57	55	58	55	55
Butter	54	46	37	30	23	24
Cheese	91	67	40	41	52	42
Potatoes	125	—34*	—24*	—39*	—36*	—40*
Hay	13	27	34	30	28	25
Wool	75	50	11	3	Nil.	—1*

* Decrease.

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The Hannah Dairy Research Institute

THE first annual report of the Hannah Dairy Research Institute has recently been published. It deals with the year ended on March 31, 1930, and explains the origin of the Institute in a concise introduction. The project of establishing a Scottish Dairy Research Institute was under consideration for some years before it took definite shape. Under the original scheme of agricultural research for Great Britain, provision was made for only one Institute, devoted specially to dairying, namely, that at Reading. The great and growing importance of the dairy industry and the range of varied and complicated problems with which it is confronted in the field of economic production, however, made it desirable to set up another Institute. Moreover, some of these problems are specifically Scottish and require a degree of local investigation which can only be undertaken with full satisfaction by a local institution.

The establishment of the Institute in 1928 was made possible by the generous gift of Kirkhill Farm, Auchincruive, near Ayr, by Mr. John M. Hannah. This is a typical dairy farm of about 120 acres. The active work of the Institute commenced in September of 1928, but owing to the necessary adaptation and extension of the buildings to suit them for their new purpose, it was not until November, 1929, that the Institute took possession of the farm. Further building operations are still in progress, complete plans and full details being given in the Report. It is hoped that the work of the Institute will be the more valuable because of the intimate connexions which have already been established between it and Glasgow University, the Royal Technical College, Glasgow, and the West of Scotland Agricultural College.

It is natural that so far the amount of work completed at the Institute is small, but some useful pieces of research are already on their way. These include investigations in "The Protein Requirements of Dairy Cows," "Inheritance of Milk Yield," "Milk Fever," various aspects of Tuberculosis and of the "Utilisation of Milk Residues."

The final pages of the report give details of the present finances of the Institute and of its requirements for future work, as well as a list of the six papers and one bulletin already published by its staff.

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International Agricultural Legislation in 1928

THE International Institute of Agriculture has recently published a further volume of the International Yearbook of Agricultural Legislation, dealing with the laws relating to Agriculture passed during 1928 throughout the world. The volume, which consists of 900 pages, contains a complete series of laws, decrees, and regulations, published in a large number of countries during 1928, the full text or the title only being given according to the importance of the subject. The laws treated in the present annual refer to the following subjects :—

Trade in agricultural products, machines, fertilizers and livestock ; laws dealing with finance and customs regulations ; plant and animal production and the related industries; agricultural organization and instruction ; plant diseases ; co-operation, insurance and agricultural credits ; land tenure ; relations between capital and labour in agriculture ; rural hygiene and policy.

Owing to the importance of the questions treated and the comprehensive character of the documentary material contained, this Yearbook is indispensable to legislators, legal authorities, sociologists, economists, agricultural associations —in a word, to all who are interested either in agriculture itself or in the trade in the products of the land and their industrial exploitation. Copies can be obtained from the Ministry's Library, price 12s. 6d. post free.

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Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on Wednesday, July 16, 1930, at 7 Whitehall Place, London, S.W. 1, the Right Hon. The Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying those decisions into effect.

Cambridgeshire and Isle of Ely.—An Order fixing special minimum rates of wages for the employment of male and female workers on the corn harvest, the rate in the case of male workers of 21 years of age and over being £11 for a period of four weeks of 64 hours per week (excluding Sunday) with payment for Sunday work and for employment in excess of 64 hours per week at 11d. per hour. The special minimum rate for female workers of 18 years of age and over is 8d. per hour.

Essex.—An Order fixing special minimum rates of wages for the employment of male and female workers during the corn harvest, the rates for male workers of 21 years of age and over being (*a*) on farms of over 60 acres of corn £5 5s. 0d. for the harvest (or where the worker has worked a part only of the harvest period a due proportion of such sum) in addition to the ordinary minimum weekly wages and in lieu of overtime rates ; the hours in respect of which the harvest wages are payable are not to exceed 11 per day ; (*b*) on farms of 60 acres of corn and under 10½d. per hour for all employment on harvest work. The special minimum rate for female workers of 21 years of age and over on all farms is 7½d. per hour for all employment on harvest work.

Hampshire and Isle of Wight.—An Order fixing special differential rates of wages for overtime employment of male workers on the corn harvest, the rate in the case of male workers of 21 years of age and over being 9d. per hour.

Suffolk.—An Order fixing special minimum rates of wages for the employment of male workers during the corn harvest, the rates for such workers of 21 years of age and over being (*a*) in the case of farms of at least 60 acres of corn £5 for the harvest in addition to the minimum weekly wage and in lieu of overtime rates, the hours in respect of which this rate is payable being 12 on any weekday whilst the crops are being carted and 11 whilst other harvest work is in progress, but so that the hours in any one week shall not exceed 70. Where a worker is employed for a part only of the harvest the special minimum rate is 10d. per hour for all employment on harvest work ; (*b*) in the case of farms of less than 60 acres of corn 10d. per hour for all employment on harvest work.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

Enforcement of Minimum Rates of Wages.—During the month ending July 14, legal proceedings were instituted against nine employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines £ s. d.	Costs £ s. d.	Arrears of wages £ s. d.	No. of workers involved
Cornwall	Camborne	2 0 0	—	12 10 0	1
Devon	Moretonhampstead	—	—	11 14 0	1
Gloucester	Dursley	8 0 0	5 0 0	125 5 5	4
Hereford	Weobley	*	—	2 8 0	1
Northampton	Thrapston	4 0 0	0 5 0	10 5 9	1
Worcester	Tenbury	1 1 0	—	20 17 0	2
Worcester	Worcester	8 0 0	0 12 6	66 10 0	4
Yorks E.R.	Hull	2 0 0	—	30 4 3	1
Brecon	Hay	—	0 10 6	10 0 0	1
		£25 1 0	£6 8 0	£289 14 5	16

* Dismissed under Probation of Offenders Act.

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APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

Essex: Mr. J. C. Leslie, M.A., B.Sc., has been appointed Agricultural Organizer and Principal of the East Anglian Institute of Agriculture, *vice* Mr. D. B. Johnstone-Wallace, M.Sc., N.D.D.

Gloucestershire: Mr. R. Line, B.Sc., N.D.A., has been appointed Assistant Instructor in Agriculture. (Previously employed in a temporary capacity.)

Northamptonshire: Miss E. T. Wilson, N.D.D., has been appointed Assistant Instructress in Poultry Keeping.

WALES

Cardiganshire: Mr. H. Powel Evans has been appointed Poultry Instructor.

Miss R. M. Evans, formerly Instructress in Dairying and Poultry Keeping, now becomes Dairying Instructress.

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NOTICES OF BOOKS

The British Goat Society's Year Book for 1930. Pp. 200. Compiled and issued by the Honorary Secretary, Thomas W. Palmer, 10 Lloyd's Avenue, E.C.3. Price 1s. 6d.

This volume, packed with interesting and useful information, is of more permanent value than is usually suggested by the term "Year Book." Mr. S. B. Thomas, M.Sc., contributes a chapter on "The Hygienic Production of Goats' Milk," giving results of the examination of some 200 samples at the Dairy Bacteriology Laboratory, Aberystwyth, during the past twelve months; also an account of the Goats' Milk Competition which was organized last year by the Cardiganshire Agricultural Education Committee. Dealing with the "Composition of the Milk of British Breeds of Goats," Mr. J. C. Urquhart, B.Sc., gives his opinion on points which have been keenly debated among goat-keepers, *e.g.*, the extent to which deterioration takes place in the quality of milk as a result of the disquieting atmosphere of shows, or consequent upon large increases in yield. The writer thinks that in neither case can anything more serious result than a slight diminution in the butter-fat content. "Deficiency Diseases" is the title of an article by F. E. Corrie, B.Sc. Dr. D. O. Morgan, M.Sc., of the Institute of Animal Parasitology, writes on "The Entozoal Parasites of the Goat in Britain," a subject which has not yet received the attention it deserves. Mohamed Askar Bey, Director of the Higher Veterinary School of Egypt, traces "The Origin of the Anglo-Nubian," while Captain O. W. Andrews deals with "Military Goats." Of special interest is Mr. H. S. Holmes Pegler's article on "Milk Yields Past and Present," showing how the 7 lb. per diem average of 1894 has been increased to 13 lb. and over at the present day. Excellent illustrations, statistical tables, advice on butter and cheese making and dietary, and other useful data combine to make this an indispensable manual of reference for the goat-keeper.

Growing Tree and Small Fruits. By H. B. Knapp and E. C. Auchter. Pp. 510. (London: Chapman & Hall, Ltd. New York: John Wiley & Sons. 1929. Price 15s. net.)

The authors have prepared this book to meet the needs of schools in teaching "the boys and girls of to-day who will be the fruit growers of to-morrow." If studied effectively, students should acquire a good knowledge of growers' practices in hardy fruit, for these are described with great thoroughness. The book begins with "Harvesting, Storing and Marketing," a peculiar inversion of the normal order of things, but, nevertheless, a good one, for the authors make the point that only high grade fruits are required. From that point, the students are brought to consider the establishment of an orchard, and the care of trees, which can be calculated to produce "market fruit."

The wild French crab is the stock recommended for apple, and the trees are planted at 40 ft. square; filler trees are the exception rather than the rule. Where interplanting is practised, the "filler" trees are dwarf on Wild Paradise, or "semi-dwarf" on the Doucin—both stocks of European origin. The normal American practice is to incrop, not with filler trees, but with annual crops, of which a large number are used. This work can be contrasted with the closely-planted and mixed fruit plantations of England.

After describing, in simple language, tree growth and fruit bud formation, the authors say that "experiments have shown that most soils are supplied with sufficient available amounts of essential elements, but that for the best growth and fruiting, nitrogen seems to be lacking in many soils and should be added." This statement, so different from what could be said regarding English orchards, shows how nutritional treatment must vary with environment. American summers are full of sunshine; those in this country have many wet and dull days.

Cropping can also be induced in trees under American conditions by ringing and notching; but the dwarfing caused makes the practice questionable when several years are considered. American methods of pruning also seem strange to us, for the authors recommend (*a*) the light pruning of young trees and (*b*) the heavy pruning of old bearing trees.

Only short (but adequate) references to insect pests and fungus diseases are given; but spraying and, still more important, the machines

used for spraying are described in great detail. The illustrations show that these machines, although very large and powerful, are taken down the rows, the trees being sprayed whilst the machines are slowly moving forward. For apple spraying, the schedule of sprays recommended comprises six applications of lime-sulphur, to some of which nicotine and lead arsenate are added. Machines for "dusting" are also fully described but tar-oil washes do not seem to be used. The cost of the six sprayings, assuming 10 gallons per tree, per application, and 30 trees to the acre, is estimated at the low figure of 55·36 dollars per acre, which is an excellent testimonial for the spraying machinery.

The book is full of good advice and sound knowledge, and is made easy of understanding by the clarity of the writing and the numerous photographic illustrations. It can be recommended to all interested in fruit growing, and, with due deference to the authors' intention, seems to be even more suited to the requirements of present growers than to those who "will be the fruit growers of to-morrow."

The Agriculture of Rumania During the War. (*L'Agriculture de la Roumanie pendant la Guerre.*) By G. Ionesco-Sisesti. Pp. xii + 135. Publications of the Carnegie Endowment for International Peace. (Paris: Les Presses Universitaires de France. New Haven, U.S.A., Yale University Press. London: Humphrey Milford, Oxford University Press. 1930. Price 5s. net.)

Perhaps all that most of us know about Rumania is that the country used to export large quantities of cereals before the war, and has sufficiently overcome her difficulties since to enable her once more to export similar quantities. The conditions under which surplus production was obtained before the war and the changes which have been necessary to enable it to be obtained once more are equally little known. M. Ionesco-Sisesti's book is the more welcome on this account, following, as it does, his short essay on *Land Reform in Rumania* which appeared in the *Manchester Guardian Commercial Supplement: Reconstruction, in Europe Section Six*, of August 17, 1922.

In spite of its large exportable surplus, Rumanian agriculture was in a low stage of development before the war, and it is surprising to learn that, although iron ploughs were used everywhere, seed-drills were used only on the farms of the large landed proprietors. The peasants used the medieval type of bush harrow, very rarely the iron-tined modern type. Reaping machines were found on large estates, but even on those estates hundreds of thousands of hectares were reaped by hand. Cultivators were almost unknown, as were field drainage methods.

Nevertheless, the country produced much more than the people could consume and this surplus was of great interest both to the Allies and to the Central Powers at the outbreak of war. Rumania was placed in a particularly difficult position by the fact that the war immediately effected a closure on her lines of export. The mine area of the Dardanelles forbade export by sea, and the military operations between Austria and Serbia did not permit transport along the Danube to the Central Powers. The economic stability of the whole country was threatened by this conjunction of affairs and, although the national interest of the country was with the Allies, her economic interest tied her to the Central Powers.

The Central Powers entered into contracts for the purchase of the Rumanian products and, by the time the first contract was made in 1915, the Danube was re-opened. A second contract was made in 1916 and the supplies obtained from this source certainly prolonged and sustained the resistance of the Central Powers. Britain had meantime made offers to buy the stocks in order to immobilise them and a large

quantity of supplies had been covered by a contract made early in 1916, but this was not completed when Rumania entered the war. Almost immediately, she lost nearly two-thirds of her territory and that the most productive part.

Measures were taken by the Central Powers to exploit the resources of the occupied area immediately the line consolidated, and these measures were not so very different from those forced upon the Rumanian Government for the protection and supply of its remaining territory. Both systems are described in detail in this book, as are the measures taken by the Government on the conclusion of peace to restore the agriculture of the country to its pre-war condition. The expropriation of the large proprietors in favour of the peasants, their equipment with seed and material, and the steady improvement in output until the 1927 exports equalled the 1913 level, are a study in method of administration under difficulties; and it must be added that the exportable surplus is now obtained in addition to a larger internal consumption arising from an improved general standard of living.

This book is a careful study of a limited, but significant, period in the history of a people whose economic stability depends upon a prosperous agriculture, and as such is worthy of careful reading. For anyone who desires a wider background, it should be read in conjunction with Ifor L. Evans' *The Agrarian Revolution in Rumania*, 1924, although it obviously carries the story a stage further than Evans.

Dairy Farming: Most Milk and Profit per Acre. By Wilber J. Fraser. Pp. xiv + 333. Illus. (London: Chapman & Hall, Ltd. 1930. Price 17s. 6d.)

This book is written round the results obtained in the *Most Milk per Acre Demonstration* carried out for six years at the College of Agriculture of the University of Illinois, where the author is Professor of Dairy Farming. It is intended to be used as a textbook for agricultural students and a handbook for dairy farmers, and is written in a pleasingly persuasive style, each step in the progress of its argument following naturally and easily from the previous one. The whole range of the industry is covered, the general plan proceeding from the selection of cows and bulls, through rationing and the feeding system to be adopted with home-produced foods, the rotations necessary and their planning, the housing and care of cows, and disease, to the final stages of care of the product and its marketing.

The scheme detailed rests upon the use of lucerne for grazing, and hay with corn (maize) silage for winter feed, and the use of sweet clover for summer pasture. Much emphasis is laid upon the necessity for liming acid soils. Naturally enough the plan of work is built up round the crops of what is known as the corn belt in the Middle West of the United States, and before it could be adopted in this country a crop of equal value to maize for feeding and yield would require to be substituted in the rotation and in the feeding scheme. This does not perhaps present an insuperable difficulty. Apart from this, however, the book contains much homely wisdom often neglected by the dairy farmer both of the district where it was provoked and in this country. Moreover, there is a great deal of practical advice which a wide acquaintance with the problems of the dairy farmer has enabled Professor Fraser to present in a manner which will render it useful not only for the dairy farmers of his State, but also to those of this country. Like most American textbooks each chapter is concluded with a short list of books which may be studied by those who wish to pursue the subject further.

The Inspection of Fish, Poultry, Game, Fruit, Nuts and Vegetables. By A. Horace Walker. Pp. viii+253. Illustrated. (London: Balliere, Tindall & Cox. 1930. Price 12s. 6d. net.)

The first edition of this work was published in 1911, since when the science of food inspection has advanced very rapidly. This has rendered a complete revision of the text necessary; moreover, new features have been added to this, the second edition, which it is hoped will render it more useful to students of the subject. The major portion of the book deals with the inspection of fish, but the author deals adequately also with the other foodstuffs enumerated in the title. Not only are the varieties of the various edibles described and, in many cases, illustrated, but the diseases to which they are subject are covered and instructions given to enable them to be identified. Modern methods of preservation and storage are also considered and some indication of the effects on public health resulting from the consumption of badly preserved, diseased and polluted food is given. This revised edition of the book should be found most useful by those concerned in food inspection.

The Welsh Journal of Agriculture. Vol. VI. 1930. Pp. 367. (Cardiff: Published for the Welsh Agricultural Conference by the University of Wales Press Board. Price: paper 2s. 6d., cloth 4s.)

This, the sixth volume of this Journal, maintains the standard it has set up for itself during its brief but useful life. Readers of the Ministry's JOURNAL will already be familiar with its make-up and the general character of its contents. The present volume is larger than its predecessors and contains a larger number of articles dealing with the practical economics of Welsh farming. Since three-fifths of the agricultural land of Wales is devoted to pasture and rough grazings, it is natural to find that the major portion of the technical contributions deal with subjects related to grassland and its improvement, while others deal with root and fodder crops. The importance of sheep in the Welsh agricultural industry is well known, and the two essays which deal with types of sheep are useful and relevant. The grazing and dairy sections of the industry are also catered for, and the Journal is rounded off with a useful set of classified abstracts of the literature which was published during 1929.

Dairy Enterprises. By John C. McDowell and Albert M. Field. Pp. vi+471. Illustrated. (London: J. B. Lippincott Co. 1930. Price 10s. 6d. net.)

The writers of this book are, respectively, the Head of the Division of Dairy Herd Improvement Investigations of the United States Department of Agriculture and the Associate Professor of Agricultural Education in the University of Minnesota. The book may, therefore, reasonably be regarded as authoritative for the leading dairy region of America. How far the principles laid down can be applied to the industry in this country must, however, be decided by those who read the book with that object in view. There are, nevertheless, many main principles which are equally appropriate to both countries.

The book, which seems to have been prepared primarily for the use of vocational educational institutions, is arranged in "jobs" instead of the chapter headings to which we are accustomed here. This does not, however, make any really material difference in the contents, which cover the whole gamut of problems involved in dairy farming from the preliminary decision to adopt that branch of the agricultural industry as a means of livelihood to the marketing of the products.

SELECTED CONTENTS OF PERIODICALS

Agriculture, General and Miscellaneous

Agriculture in Lancashire. *J. J. Green.* (Jour. Roy. Agric. Soc. of Eng., Vol. 90 (1929), pp. 42-55.) [63 (42).]

The Agriculture of North Wales. *R. G. White.* (Jour. Brit. Dairy Farmers' Assoc., Vol. XLII (1930), pp. 63-67.) [63 (429).]

Farm Accounts. *W. Gavin.* (Jour. Roy. Agric. Soc. of Eng., Vol. 90 (1929), pp. 9-26.) [338.1; 63.191; 657.]

The World Shortage of Cattle: Its Future Effects on British Agriculture. *W. S. Haldane.* (Jour. Roy. Agric. Soc. of Eng., Vol. 90 (1929), pp. 26-42.) [338.1 (42); 338.9; 63.62; 63.75.]

Agriculture and the Food Supply. *J. A. S. Watson.* (Scottish Jour. Agric., XIII, 2 (April, 1930), pp. 133-140.) [338.1 (41); 338.9.]

The Future of British Agriculture. *T. Wibberley.* (Trans. Surveyors' Inst., LXII, 5 (April, 1930), pp. 216-228.) [63 (42); 63.191.]

The Farm Cottage in Scotland. *J. F. Duncan.* (Scottish Jour. Agric., XIII, 2 (April, 1930), pp. 140-153.) [333.32.]

History and Development of the Rothamsted Agricultural Experiment Station. *E. H. Godfrey.* (Scottish Jour. Agric., XIII, 2 (April, 1930), pp. 164-172.) [37 (072).]

Modern Seed Testing. *R. G. Stapledon.* (Sci. Prog., XXIV, 96 (April, 1930), pp. 623-642.) [63.1951.]

Mole Draining: Report on Trials conducted at the Agricultural School, Ballyhaise. *D. Delaney.* (Jour. Irish Dept. Agric., XXIX, 2 (1930), pp. 205-207.) [63.14.]

The Evolution of Field Drainage. *G. E. Fussell.* (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. IV (1929-30), pp. 59-71.) [63.14.]

Experiments on the Establishment of Rice Grass (Spartina Townsendii) in the Estuary of the Lee. *H. A. Cummins.* (Econ. Proc. Roy. Dublin Soc., Vol. II, No. 26 (March, 1930), pp. 419-421.) [63.12.]

Responses of Plant-Tissues to Electric Currents. II. *H. H. Dixon* and *T. A. Bennet-Clark.* (Sci. Proc. Roy. Dublin Soc., Vol. 19, N.S., No. 34 (April, 1930), pp. 415-420.) [58.11.]

The Preparation of Willow Rods for Industrial Use by Decorticating Machinery and its Economic Significance. *H. P. Hutchinson.* (Jour. Bath and West and S. Counties Soc., Sixth Series, Vol. IV (1929-30), pp. 180-185.) [63.3412.]

Agricultural Economics

What Should a Farmer Produce? *A. G. Ruston.* (Essex County F.U. Year Book, 1930, pp. 239-260.) [338.1.]

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The Live Stock of Lancashire. *H. Holderness.* (Jour. Roy. Agric. Soc. of Eng., Vol. 90 (1929), pp. 55-69.) [63.6.]

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THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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NOTES FOR THE MONTH

Statement on Agricultural Policy

THE following statement on agricultural policy was made in the House of Commons by the Rt. Hon. Philip Snowden, M.P., Chancellor of the Exchequer, on August 1:—

(1) In view of the depression which exists in certain branches of the agricultural industry, and the urgent need for reform in methods both of marketing and production in order to take advantage of our valuable home market, the Government have given anxious consideration to the agricultural problem, with especial regard to the desirability of increasing employment on the land with good standards of living, recognizing that this can only be assured through prosperity in the industry.

(2) *Holdings for Small Cultivators.*—Proposals will be submitted for making land more freely available for small cultivators and affording them adequate security of tenure.

Local Authorities will be stimulated to meet the large and unsatisfied demand for small holdings, cottage holdings and allotments. In addition, the Minister of Agriculture will be given powers to acquire and manage land for these purposes, so as to supplement but *in no way to supplant* Local Authorities that are active. Powers to provide cottage holdings will be extended to County Borough Councils, and these holdings will be made available for letting as well as sale, and for a wider class of applicant.

Unemployment Scheme.—A scheme will be undertaken whereby a contribution may be made to the mitigation of unemployment by the creation of a special class of allotments and of market garden and poultry holdings up to 5 acres for suitable unemployed workers.

(3) *Large-Scale Farming and Demonstration Farms.*—An Agricultural Land Utilization Corporation will be established

to conduct, on the one hand, large-scale farming, managed on business principles, with the utmost possible application of improved methods and the best machinery, with the particular object of affording to agriculturists a practical training in business management; and on the other hand, additional Demonstration Farms of various types in different parts of the country, designed to secure the quicker and more general adoption of every agricultural improvement.

(4) *Scotland.*—In Scotland, the Department of Agriculture will make every effort to increase the number of small holdings available. At the same time investigations will be set on foot for improving certain large tracts of barren and moss land and for reclamation works. Arrangements are under consideration for the extension of the Agricultural Credits Act, 1928, to Scotland.

(5) *Cereals.*—The critical position of cereal farmers demands the earliest possible attention. The question of the condition of this class of agriculturists in different parts of the Empire will be discussed at the forthcoming Imperial Conference with special reference to Bulk Purchase, Import Boards and Stabilization of Prices. In view of this, and of the possibility that the conclusions of the Conference on this matter may materially change the practical problem of dealing with cereal farming, the Government is not in a position at present to formulate comprehensive proposals for this part of the agricultural situation beyond the plans outlined in this statement for improved methods of cultivation, the better organization and marketing of produce, education and research, and improved credit facilities. But as soon as the conclusions of the Imperial Conference are known the Government will undertake whatever practicable steps can be devised to put cereal growing in this country on an economic foundation.

(6) *Agricultural Marketing Bill.*—It is an urgent necessity to give our home producers opportunities of orderly and better marketing in our industrial market.

A Bill is being introduced forthwith for purposes of criticism and comment, which offers certain powers to large-scale commodity organizations initiated by producers themselves for the marketing of home-produced agricultural products, and protects such organizations from the disruptive action of minorities. There are precedents for legislation of a similar kind in overseas parts of the Empire.

The Bill contemplates organizations of two distinct types, though combinations of both are possible. First, there is the older and better-known pool type which is well adapted for products in respect of which we are largely self-supporting and of which the market may be disturbed by recurring surpluses. The Bill also provides for organizations of the regulatory type which are concerned more with the craft of marketing than with the physical control and handling of the product, and which, after the manner of a board of directors, would formulate a coherent marketing policy for the home product and carry it into effect.

Financial assistance by way of both long and short term loans will be available for these commodity marketing boards.

Care has been taken to provide safeguards for the great body of consumers and for other affected interests.

(7) *Abattoirs.*—The erection of publicly-owned abattoirs by Local Authorities for the centralized slaughtering of live stock will be encouraged.

(8) *Education and Research.*—The development of agricultural education will also form an important part of our policy. An Agricultural Research Council is being constituted to secure improved co-ordination and extension of agricultural research throughout the United Kingdom. In view of the great losses incurred through disease, among the first subjects to receive attention will be contagious abortion, tuberculosis and swine fever.

(9) *Scrub Bulls.*—Legislation will be introduced to regulate the use and import of bulls, with a view to improving the standard of our livestock.

(10) *The Agricultural Worker.*—Apart from the increased provision for access to land for their own cultivation that the policy affords to suitable workers, it is important that agricultural workers should share in any added prosperity which may accrue to the industry, and the working of the existing machinery for regulating wages will be carefully watched with this object in view.

(11) *Housing.*—The present Housing Bill contains provisions which should mitigate the evil of the tied cottage, to which we attach great importance, and it is the intention of the Government to take special steps to stimulate the provision of improved housing in rural areas under the powers therein provided.

Further, a Committee which is to be appointed to consider the Rent Restriction Act will include within its purview the special position of the "tied cottage," with a view to providing a remedy against any unfair use of this system.

(12) *Conclusion.*—The Government is convinced that by a sustained and well-directed effort designed to evoke the co-operation of the industry itself it should be possible to arrest the decline of employment on the land, and to foster, by taking advantage of modern developments and facilities, specialized and improved methods of production which should result in a great increase in our home-produced food supplies and bring back prosperity to our countryside. It is believed that these proposals will have the effect of inspiring in all sections of the farming community that confidence which is so essential to its progress and welfare, and will promote the sound development of the great agricultural industry.

* * * * * *

Land Drainage Act, 1930

The Land Drainage Act, 1930, is the result of the report of a Royal Commission on Land Drainage set up on March 26, 1927, under the Chairmanship of Lord Bledisloe, which completed its task of investigation and reported on December 5 of that year.

The Act marks the beginning of an important new era in the history of Land Drainage Law. The law which the Act replaces extends over a period of several hundred years, dating from Henry VIII and even earlier times, and has been described at different times as anomalous, obscure, vague, ill-defined, lacking in uniformity, and even chaotic.

The Act is a consolidating and amending Act, but at the same time it introduces certain important new principles.

Up to the present time, the Law of Land Drainage has provided facilities for the setting up of drainage districts on a comparatively restricted basis, owing to the fact that its underlying principle has been that only those who benefit by, or escape danger as the result of, drainage operations have been liable to pay drainage rates.

The limitation thus placed upon the powers hitherto existing has rendered it impossible, in normal circumstances, to bring within the scope of one comprehensive Drainage Board any considerable river or the area served by it, owing to the difficulty of finding from the area which could be legally rated (*i.e.*, the area of benefit or the area of escapement of

danger) sufficient money to meet the cost of maintaining that river, without crippling the resources of the district.

It is true that an attempt was made in 1920 in the case of the Great Ouse to place the bulk of the main river under the jurisdiction of a Drainage Board constituted under the then existing law, but the experiment did not prove successful, and the difficulties of rate collection that arose in that district, where something of the nature of an impasse was created, tended to spread to other districts.

Accordingly when the Royal Commission came to review the situation they realized that the fundamental defect in the law of land drainage was that the area of rating was inadequate to secure the carrying out of comprehensive works on the larger rivers, which were consequently becoming neglected and increasingly unable to carry away the water poured into them, either naturally by gravitation or artifically by pumping, from the areas of the many small drainage boards who were doing their utmost to keep their smaller arterial drains in an efficient state.

The Commission recommended, therefore, that the catchment area of each river, viz., the area bounded by what is geographically known as the "watershed" or "water parting," should be the unit for land drainage, and that a comprehensive body, to be known as a Catchment Board, should be set up where necessary for each such catchment area with full control over the main river within the area, and a general power of supervision over the smaller drainage boards which now exist, and which will continue to exist in the future on the old basis of area of benefit and escapement of danger.

The Commission also recommended (and this is perhaps the most drastic of their reforms) that the whole catchment area should contribute towards the cost of the main river works, while the Internal Drainage Districts (who would continue to exercise their functions) should continue to find the cost of their internal operations from their own areas, and should, at the same time, be liable to contribute towards the cost of the Catchment Board's operations.

The Catchment Board will thus be in a position to do all that is necessary on the main river, and to obtain the necessary funds for so doing, by precept, from two sources, viz., from the County Councils and County Boroughs within the area, and from the Internal Drainage Boards within the area.

In this connexion it should be realized that the County Council precept will be raised in the same manner as any other County and County Borough rates, viz., without any contribution from agricultural land and with only a partial contribution from productive industry. On the other hand, the contribution to be found by the Internal Boards will be levied on all hereditaments, as "*derating*" does not apply to drainage rates.

It is true that large areas (including urban areas in the upper reaches of a river, whose contribution to the waters of a river are ever increasing, owing to the constant spread of urban development) are under the Act placed, for the first time, under an obligation to contribute towards the expenses of maintaining the river for drainage purposes. On the other hand, the new Catchment Boards are thus assured of adequate financial resources to carry out the vital task of putting the main rivers of England and Wales into a state of efficiency.

So far as the drainage of areas served by tributary rivers and smaller streams, artificial and otherwise, is concerned, the Authorities existing prior to the passing of the Act will continue to function, but with the more adequate and up-to-date powers conferred upon them by the Act. Ample facilities are provided for the setting up of further Authorities of this nature wherever required. The area which these Authorities will control will still be upon the old basis of benefit or escapement of danger, but they will in future carry out their powers with the knowledge that there is operating upon the main river (into which the waters of the Internal Board ultimately discharge) a comprehensive Authority competent to carry out the necessary works and armed with the necessary financial resources.

In conclusion it must not be overlooked that the Government have recognized the principle of affording financial assistance to the new Catchment Boards in the execution of their duties, and the Act provides that Government contributions can be obtained by Catchment Boards in the carrying out of new works and the improvement to existing works. This does not in any way interfere with the present financial facilities which are being afforded to existing Drainage Authorities, either under the programme of the Ministry of Agriculture and Fisheries or under that of the Unemployment Grants Committee. These financial facilities will continue so long as the Government's Unemployment Relief programme is in existence.

Impressions of the Poultry Congress

IN the next issue of this JOURNAL an article giving an account of the fourth World's Poultry Congress which was held at the Crystal Palace from July 22-30 will be published. It was a pleasure to welcome so many and varied visitors from such a multitude of countries; the one "fly in the ointment" was one's limitations as to language, though English, French and German will usually suffice to meet all the needs of such functions. Yet other European languages, Japanese or almost any tongue would have been useful.

Taking a systematic walk round the exhibits, and bearing this JOURNAL in mind, one was irresistibly drawn by the words of Burns :—

"A chiel's amang ye takin' notes,
An' faith he'll prent it."

Those who attended the Congress in a really interested capacity—whether official, as practical producers or from the trade standpoint—must have felt the liveliest satisfaction at all they saw, and have left subsequently with the happiest recollections of friends made and a good cause served. May many of them meet again at the fifth Congress to be held three years hence in Italy!

There was much at the Congress which was calculated to leave lasting impressions—and impressions of varying type. The opening by H.R.H. The Duke of York; the indefatigable attentions of the organizing staff; the energy and propagandist capacity of Mr. F. C. Elford and Sir Edward Brown; the wonderful exhibits of Canada, the United States, Germany, Northern Ireland, the Irish Free State, the Empire Marketing Board, the Ministry's marketing demonstration, etc.; the highly interesting and educational films in the cinema; the 172 papers presented by delegates and others; the trade displays; the choice and varied exhibits of poultry, comprizing in all some 7,000 head; all these and much more—not forgetting the delightful music—combined to fascinate delegates, other members and public alike.

Among the poultry were very many breeds which few British poultry keepers can have seen or heard of before. Glancing at them at random, one noted the Plymouth Buffs, Buttercups and Bourbon Red Turkeys from the United States; the Japanese Sumatra Blacks and Silkie Whites; Partridge Styrians and White Capouns from Yugo-Slavia; Kecskemet bare-necks from Hungary; Nakthahns and the

pearly or opal Porzellan bantams from Germany; the Ascel and Karah Nath breeds from India; Wittekraaikoppen, Lakenvelders, Welsummers and Witkuiven from Holland; the English Marsh Daisy; Polverara Blacks and Ghigi's Bantams from Italy; and the attractive series of Italian guinea fowls, including the Mitrata, Crested, Vulturine and Ghigi's Blue. Some of these breeds are found occasionally in England; the Silkie, for example, has been used in breeding experiments, and the Welsummers appears to be a promising breed which produces large dark brown eggs, and is already being kept on a poultry-farm scale.

Wandering hither and thither in the Palace, one was disposed to wonder whether such a babel of tongues spoken by the representatives of the sixty nations taking part in the Congress had ever resounded since the Babel of the Old Testament. Perhaps the one common tongue—and certainly the most incessant—was that of the thousands of fowls! At one spot were met several small boys carrying paper bags with literature of the Scientific Poultry Breeders' Association, and an expression of the hope that they would read their collection elicited the ungrammatical reply, "My dad will, not me."

It ought to be mentioned that a number of new Bulletins on poultry subjects, just issued by the Ministry, were on sale at two publications stands, and some 1,375 copies were sold.

At the Government luncheon before the opening ceremony, it was stated by Earl de la Warr, Parliamentary Secretary of the Ministry, that this country imports poultry products to the value of £70,000 daily. Is not this fact alone sufficient hint to our farmers?

The full results of the Congress may not be apparent for some months, perhaps even years, but it can safely be said that the Congress was a resounding success.

* * * * * *

Field Drainage, Water Supply and Claying of Fenland: Assisted Schemes

IN an earlier issue of this JOURNAL (October, 1929) particulars were given of grants which the Ministry was authorized to offer towards the cost of approved schemes of field drainage and water supply, with a view to the improvement of agricultural land and conditions in rural areas and the alleviation of unemployment. Reference was made in the May, 1930, issue to the extension of grants to schemes

Le Mans Cock. Exhibited by the Marquise de Donet de Graville. (France.) Photo: C. Hossquet.

Partridge Albertan Hen. Exhibited by Mr. John E. Wilkinson. (Canada.)

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Silver Padua Pullet. Exhibited by Mr. G. Bronk, junior. (Netherlands.)

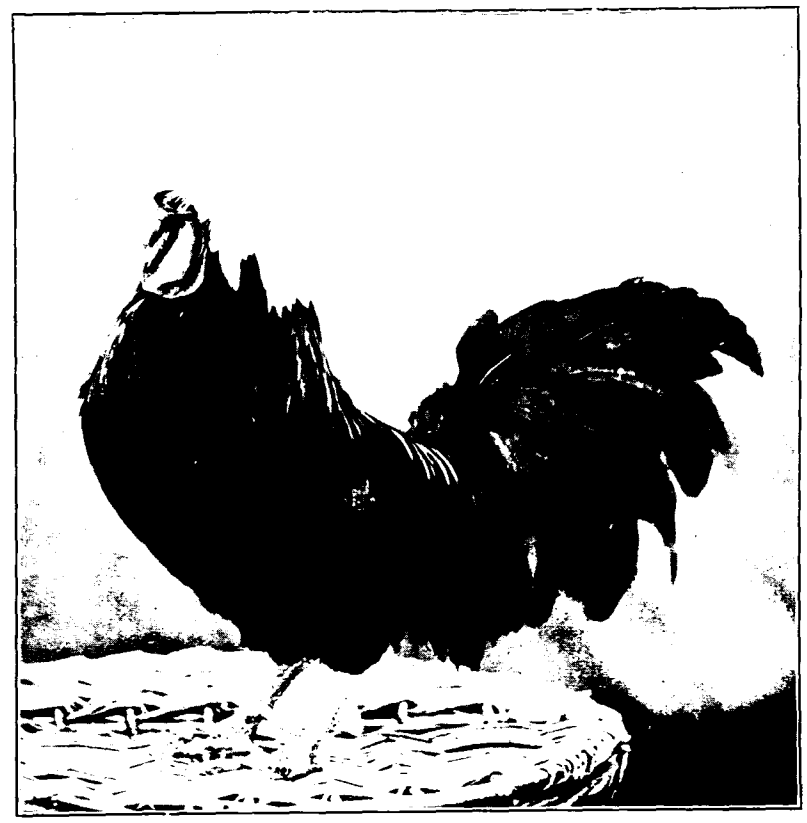
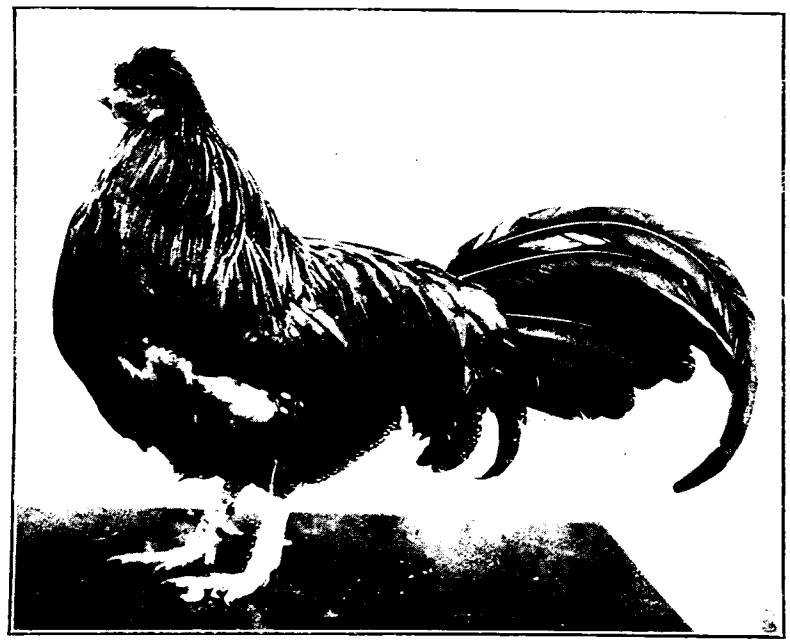
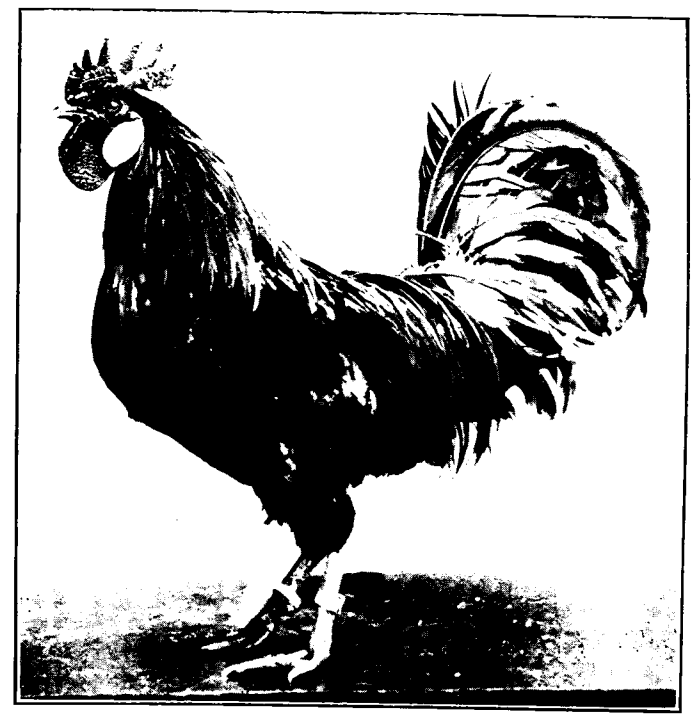


Photo: C. Hosegood.

Hollandsche Witkuiven Cockerel. Exhibited by Mr. G. Bronk, junior. (Netherlands.)



Partridge Capoun. Exhibited by the Countess Marija A. Herberstein. (Yugoslavia.)



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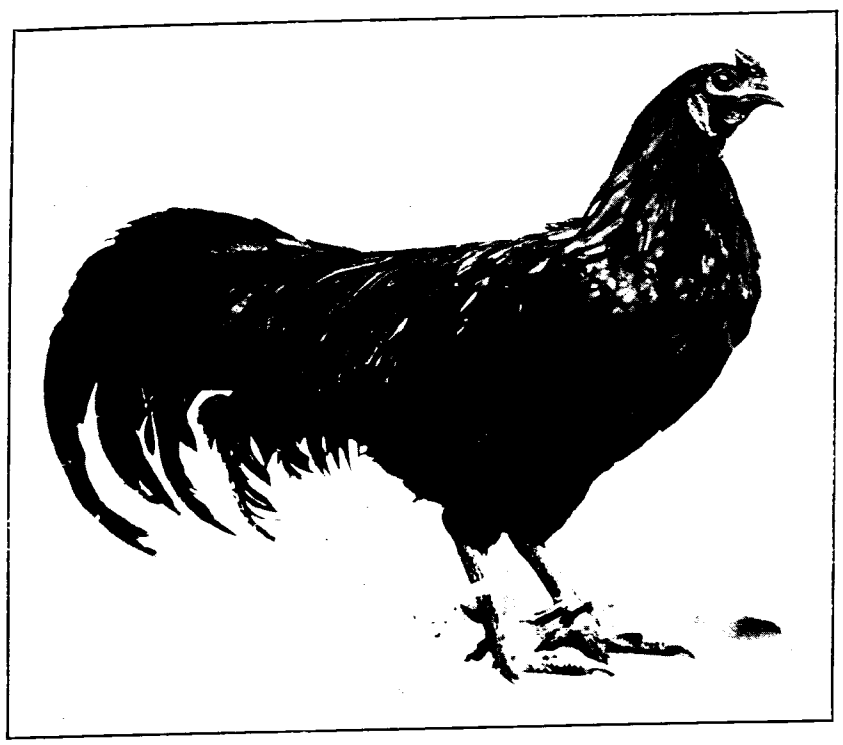
Danish Landhen Cock. Exhibited by Mr. Helge Hastrup. (Denmark.)



Black Sumatra Cock. Exhibited by Mr. Pliny Rizzo. (United States.)

WORLD'S POULTRY CONGRESS, 1930.

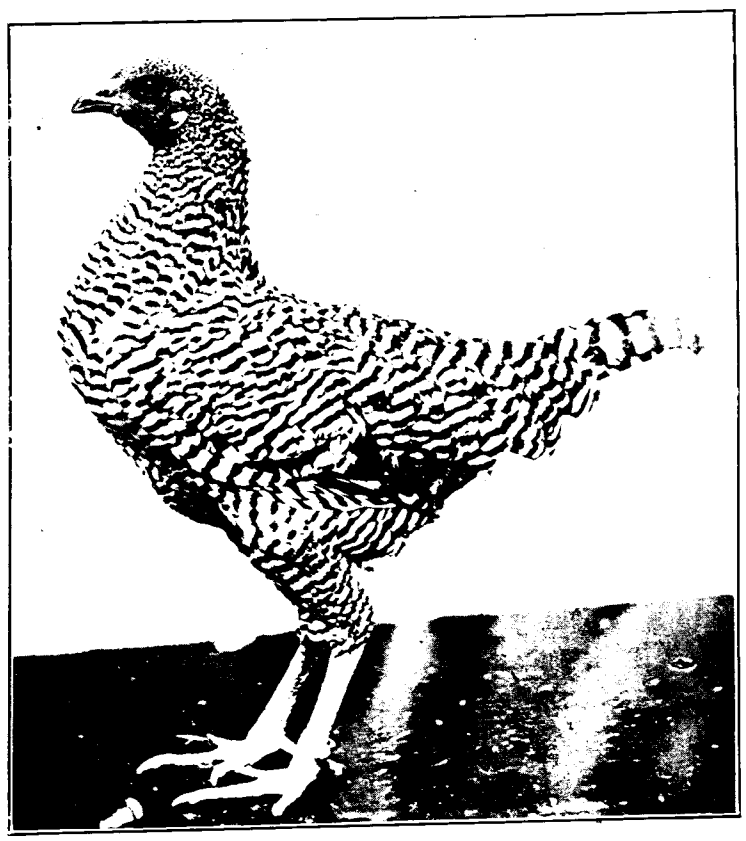
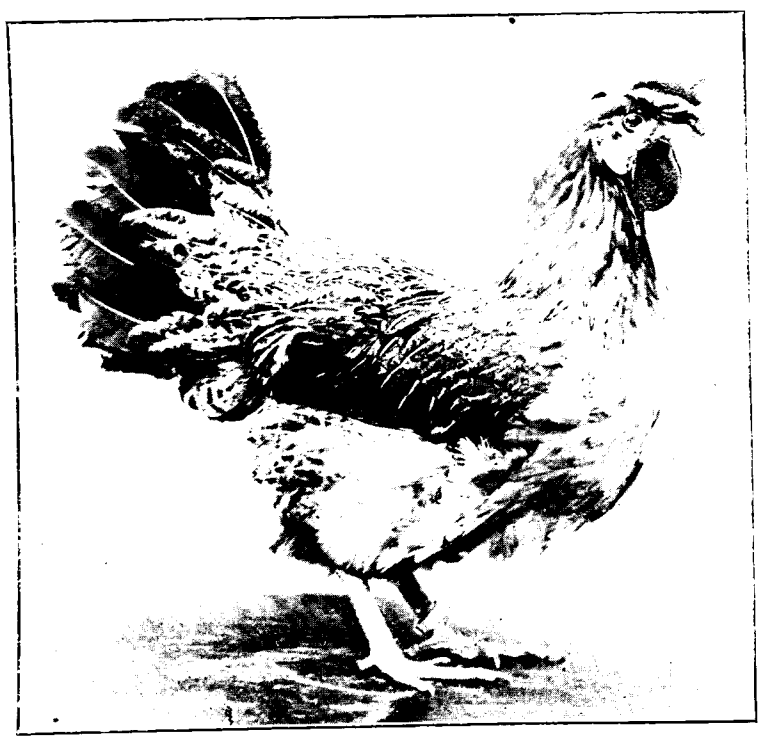


Photo: Hoch.

Barred Leghorn Cock. Exhibited by Mr. K. Weitbrecht. (Germany.)



Catalana Hen. Exhibited by the Sociedad Rural Argentina. (Argentine.)

WORLD'S POULTRY CONGRESS, 1930.

Photo: C. Bascioli.

Silver Grey Bevige Cockerel. Exhibited by the Stazione Sperimentale di Pollicoltura. (Italy.)

Argentina Negra-Ali-Blanca Duck. Exhibited by the Secretary, Rural Argentina, Argentina.

Original Dutch Fawn Indian Runner Duck. Exhibited by Captain H. Brockbank, Netherlands East Indies.

World's Poultry Congress, 1930.

for the claying of fenland. The position at the end of July with regard to the various schemes was as follows :—

	Schemes approved No.	*Work provided* Man-months	*Estimated cost* £	*Ministry's commitment* £
Field Drainage ..	421	2,223	44,072	15,200
Water Supply	114	3,073	81,800	32,479
Claying	33	225	1,613	538

Brief particulars of a few of the schemes may be of interest.

1.—A scheme of water supply to 22 farms, covering an area of 10,000 acres and estimated to cost some £10,000, is now well in hand and is giving employment to 26 Welsh miners and 24 local unemployed. The Estates Surveyor speaks most highly of the way all the unemployed are working, particularly the Welsh miners. He states that they are an exceedingly nice lot of men, but that when they arrived they were thin and anæmic-looking. When the Ministry's Land Commissioner saw them on a recent visit, however, they were full of health and happiness and those with whom he spoke expressed great appreciation of all that was being done for them. As a matter of interest, they have applied for permission to give a concert in aid of the local hospital before they leave the district. The owner's wife has purchased the necessary music and provided a piano, and Welsh harmony is heard in the village each evening.

2.—Another scheme provides a gravity water supply to an agricultural village and four dairy farms of approximately 2,500 acres. The majority of the pastures rely for their supply on small ponds fed by surface water, and on the higher ground on dew ponds. The supply to the cottages is rain water caught from roofs or water carried from springs several hundred yards away. There is a spring of wonderful capacity near the village and the scheme approved by the Ministry, estimated to cost some £3,500, provides for the use of this water by means of a pumping station, the power being derived from a stream, and a 20,000 gallon reservoir on the highest part of the parish, whence the water will gravitate to the various properties to be supplied and to concrete troughs for watering the meadows and downs.

The work is nearly completed and it is giving employment to 15 transferred miners and 7 local unemployed. The miners have settled down quietly in the village, and the contractor has paid many compliments regarding them. He was sur-

prised at the amount of work they performed, and he only wished he could at all times rely on obtaining such satisfactory unskilled labour.

3.—A third scheme, estimated to cost about £500, is for a water supply to a dairy farm carrying some 80 head of stock, with adjacent cottage. The present supply, derived from springs, is totally inadequate and of doubtful purity. The supply failed entirely in 1929 and the tenant was obliged to dispose of the whole of his stock and his three milk rounds within a fortnight. He states that this is the heaviest blow he has received throughout a long farming career and that he could hardly survive another such period.

The proposed scheme is to augment the existing supply from a shallow well already sunk near the homestead. By cutting a long trench to expose further water-bearing strata it is hoped to obtain a yield of 1,000 gallons a day. A pump and engine will be erected over the well, and the water will be lifted to a raised storage tank from which the farm house, labourer's cottage, six meadows and farm buildings will be supplied.

4.—On learning of the Ministry's offer to make grants in aid of schemes of claying on fen lands, the Norfolk County Council announced to the tenants on their small holdings estate that in the case of any claying scheme undertaken by a tenant which is approved by the Ministry for a grant of 33⅓ per cent. of the cost, they would, as landlords, contribute a similar proportion. The cost, therefore, of any approved schemes of claying undertaken by these smallholders is borne equally by the tenants, the Council and the Ministry. Applications were received from twelve tenants and duly approved. More are expected next season.

* * * * * *

The Imperial Horticultural Conference

THE Imperial Horticultural Conference, referred to on p. 426 of the August issue of this JOURNAL, was duly held from August 5-7. On the economic side of fruit production, Mr. F. L. McDougall noted the increase of fruit consumption after the War, especially of grapefruit, oranges, canned fruit and prunes. Empire produce faced keen competition chiefly from the United States, the Levant and Russia. Mr. J. L. Brown outlined the evolution and working of the New Zealand Fruit Export

Control Board. A United Kingdom representative advised as to disposal of stocks here.

The Administrative Side of Horticultural Research.—Dr. W. T. Macoun described the centralized system of Canada from its inception in 1887. The advantages were quick availability of results, co-ordination of work, avoidance of overlapping. The standpoint of an unattached Station was given in a paper by Mr. E. F. Palmer (paper read by Dr. Macoun), director of the Vineland Experimental Station, Ontario. Dr. B. Hahne's report outlined research projects in the Union of South Africa, among the most important being those on citrus and vines.

Dr. A. C. D. Rivett noted that a comprehensive study of insect pests was being made in every State in Australia, and that attention was being paid to soil science in irrigation areas. Special attention was devoted to apples in Tasmania since the reorganization of its research department. Co-operation between Commonwealth and States was necessary for success.

Dr. W. Burns, dealing with research in India, notably in Bombay, stressed the importance of transport and marketing problems.

Sir Frederick Keeble outlined the work of the research station of the British Chemical Industries at Jealott's Hill. Mr. W. G. Freeman dealt with difficulties encountered by the growers of tropical and sub-tropical fruit and their best lines of attack, with special reference to citrus fruits, bananas, avocadoes and mangoes.

Horticultural Experimentation.—Sir Daniel Hall noted the large number of problems needing solution, instancing among others the improvement of English-grown asparagus, cultural treatment of roses, the handling of tulip bulbs, etc. Mr. T. N. Hoblyn considered that the failure of earlier research on fruit trees was due to the inherent variability in the trees themselves and variation due to outside causes. These causes of error could now be eliminated by the adaptation of statistical methods to known material raised clonally. Examples were given from experiments at East Malling. Professor E. E. Cheesman thought that the same inherent variability was markedly noticeable in tropical crops, which were largely cross-fertilized and heterozygous. Here, too, in dicotyledons clonal propagation seemed to offer a solution. He instanced cacao, which was at present under investigation at the Imperial College at Trinidad. In the subsequent discussion

emphasis was laid on the desirability of close contact between the statistician and the horticultural worker, and on the importance of the close observation of individual trees in horticultural experiments. Dr. F. J. Martin showed, from instances in West Africa, that statistical methods were applicable there.

The Application of the Pure Sciences to Horticultural Problems.—Professor B. T. P. Barker considered that chemistry could help the cider industry, particularly by determining the constituents of the apple. Apples other than pure cider varieties could be used to supplement these. Investigations were in progress on the substitution of centrifuging for filtering. Professor V. H. Blackman noted that the physiological study of the effect of external conditions on horticultural crops was complicated by the inter-relationship of various factors. The solution of the stock-scion problem might possibly lie in some balance of processes, *e.g.*, enzymic action, or of ratio of assimilation to respiration. Dr. E. J. Maskell gave notes on the following very important physiological problems of cocoa: shade—seasonal march of vegetative growth—pruning effects—effect of fertilization and of nutrition on failure to fruit—fluctuations in cropping curve.

The Relation of Soil and Climate to Fruit Production.—Fruit soil surveys in this country and in Australia were discussed by Mr. T. Wallace and by Professor A. J. Prescott (paper read by Dr. A. C. D. Rivett) respectively. Soil surveys had established relationships between soil characters and the following: tree failures, growth characters, incidence of certain pests and diseases, fruit qualities. In discussion Dr. A. W. Joseph noted the need for uniformity of work and terminology in soil surveys. Mr. H. V. Taylor outlined the British scheme of research for meteorology as affecting fruit production.

Fruit Storage Methods.—Dr. Franklin Kidd divided the problems into two groups: (1) those concerned with reduction of wastage and improvement of quality, using present methods, (2) those connected with the evolution of new methods. Local testing of storage qualities was desirable, as also investigations into trade practice in handling between producer and consumer. The effects of numerous volatile substances in atmospheres of stores needed further investigation. Mr. T. Wallace noted results of experiments at Long Ashton on many factors affecting storage quality, *e.g.*, rootstocks, age of tree, manures, cultivations, pruning, thinning, ring barking, time of picking,

size of fruit, and the inter-relationship of the above factors. Dr. A. Horne dealt with the infection and invasion of the apple fruit by fungi and their effect on storage quality. The presence of high fungal numbers and many pathogenic forms in an orchard were in certain cases associated with considerable wastage under ordinary storage conditions, and low numbers and few pathogenic forms with little wastage. Resistance to invasion differed greatly. Miss H. K. Archbold showed how prolonged storage life of the apple was generally associated with a slow rate of loss of oxidizable material in respiration. Time of picking greatly influenced the chemical composition and hence the storage qualities of the apple. Mr. R. C. Palmer (paper read by Mr. W. T. Hunter) also stressed in the case of the Jonathan apple the importance of the time of picking, and showed how the basal colour of the apple could serve as an adequate guide. Drs. L. P. McGuire and C. W. Wardlaw (paper read by Professor E. E. Cheesman) described the storage qualities of certain banana varieties immune to main stalk rot, and methods for reducing wastage in transport. Mr. R. G. Tomkins dealt with the biological effect of atmospheric humidity on fruit in storage, noting its possible success in checking certain rots, its value in prolonging storage life and the practical difficulties met.

Mr. Meirion Thomas described the condition known as "Aldehyde poisoning," noting that it could be distinguished from brown heart by chemical analysis, and from other injuries and diseases of storage. This problem was proving to be of considerable economic importance.

All the above papers, together with five others, four being on storage problems and one on soil and manuring as affecting fruit production, will be published in full by the Imperial Bureau of Fruit Production as Proceedings of the Conference.

* * * * * *

Rural Community Councils Conference

ON July 17 to 20, a conference of members of Rural Community Councils and others interested in the amelioration of rural life took place at Queen's College, Oxford. Everyone in the countryside now knows something of the excellent work the Rural Community Councils are doing in the counties privileged to possess them. There are now about 20 in Great Britain, the activities of each extending over the county whose name it takes. They are scattered from the County of Angus

in Scotland to Kent and Somerset in England, though the northern part of England is not at present represented.

The Rt. Hon. Arthur Greenwood, M.P., Minister of Health, who attended an evening session of the Conference, gave an address which covered in the widest way the work and duties of these councils, and, looking ahead, advised them that their services would become much needed in the counties as voluntary helpers working side by side with the local authorities. At another session of the Conference, the rural housing problem came up for consideration, and it was clear from the discussion that the councils are anxious that the new houses and cottages put up in the country should be artistically suited to their environment and should harmonize with the older styles of dwellings found in each district. The necessity for the provision of proper house drainage—the septic tank where better cannot be obtained—and for the provision of a sound and pure water supply were matters also recognized as fundamental in making the countryside really fit for the habitation of its present and future citizens.

The question of co-operation in rural life, from the business and agricultural points of view, was dealt with by Sir Thomas Middleton, who stressed the need for closer business relationships for marketing purposes between our individualist British farmers. In the course of his remarks Sir Thos. Middleton said that the farmer's interests were at present centred in the market-place rather than on the farm. It was sale, not production, that caused him anxiety. The first stages of progress in collective action were likely to be along the lines of commodity marketing groups. Still marketing was, after all, only one side of the subject; though uppermost in our thoughts at the moment it was, he believed, the lesser of two difficulties which collective action might be called upon to face. The greater of the problems confronting the British producer was, to adopt current phraseology, the rationalizing of production.

There had been in recent times a large increase in the sale of fresh milk. This was good for the farmer and good for the consumer. We ought to use much more fresh milk; but, as he had already observed, the farmer was finding that the nation is easily satisfied. Concurrently with increase in production in the former milk-selling districts, there had come supplies from new districts rendered accessible by motor vans. These districts were the breeding grounds of store cattle; but milk brings money in a month, reared calves do not, and the result is that the milk goes to towns and the

calves somewhere. From that "somewhere" they may emerge as veal and ham or even as chicken paste, but certainly not as store cattle. Now a scarcity of store cattle reduces cattle feeding, and with it our root crops; a well-grown, well-manured root crop was still the backbone of our arable farming; the motor van reaching to the upland farm thus reacted on our tillage districts already depressed. As more tillage farmers attempt milk production the difficulties grow; for though Britain as a consuming country can draw upon the world, its farmer producers are interdependent save for the live stock bred in Ireland.

American farmers, already largely organized on a co-operative basis, had, so far as he knew, not yet heard of compulsion. The U.S. Government hoped that the necessary collective action could be obtained through co-operative organization; we must watch this situation with interest. Meantime what of our own country where co-operation had made far less progress? He asked if it were possible to secure the desirable degree of collective action by co-operative methods alone, or must there be compulsion of minorities? Both in England and Scotland agricultural opinion was divided. The experiences of those promoting the Milk Agency and the Potato Pool in Scotland strongly suggested that without compulsion success is not possible. The evidence of the need in England was less definite at the moment; but in agricultural affairs there was some justification for the belief that where Scotland is to-day England will be to-morrow.

Sir Thomas thought he could answer for the majority of farmers when he said that compulsion was an idea they disliked intensely, but if it was required to benefit the industry, it was an idea they must be contented to accept. It was, as he had already claimed, through freedom of individual action that our agricultural industry gained its high place. Nor could there be any doubt that the compulsion of minorities would at times restrict the enterprise and skill of individuals; but hard cases must be ignored if a large majority of the producers of a particular commodity were satisfied that they were suffering injury through the action of a minority; and the case against compulsion was far less likely to be supported by the progressive individual, who could almost certainly do better for himself than could a co-operative society, than by the mean person who tried to get the better of his fellows.

Family traditions and personal experience combined to make him an individualist, but it seemed to him that we

must be careful not to be led away too easily by the "freedom" argument. He preferred to approach this new policy in the attitude which his own first Parliamentary Chief, a great landowner and a great gentleman, always adopted to the tenants on his estate. His estate rule ran something like this: "Pray where you like, vote how you like, grow what you like, sell what you like, shoot what ground game you like, do what you like, so long as you do not hurt your neighbour." This, the policy which made the late Marquis of Lincolnshire a model exponent of co-operation in rural life, seemed to him to give sound guidance; and, if we accepted it, there were precedents enough for the laws which compel a man not to hurt his neighbour. Were there not cases, too, known to us, where market trespass might cause more injury than cattle trespass, or the trespass of thistle-down?

Many other subjects of interest to rural social workers were dealt with at the Conference. They included county organization in town and country, voluntary work in health services, music and the drama in the countryside, and the wide, almost all-embracing one, of education for country life. The last subject was discussed on the paper by Professor J. Scott Watson, Oxford, whose work in the field of rural social service is so widely known and appreciated. Sir Horace Plunkett attended several sessions of the Conference, and gave his blessing to it in a notable speech on the evening when, in recognition of the help which the Ministry of Agriculture had given to the movement, Sir Charles Howell Thomas, the Ministry's Permanent Secretary, was the guest of the Conference. Sir Charles told the Conference how much the Ministry appreciated the work of the councils in helping forward the improvement of rural conditions, a matter which the Ministry has very much at heart. The briefest account of the Conference would be incomplete without a tribute to the inspiration and guidance given by Professor Adams, its Chairman, who also presides over the parent body of the Rural Community Councils, the National Council of Social Service.

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THE VALUE OF WHOLE MILK AND SEPARATED MILK FOR PIG FEEDING

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[*In* 1928 *the Ministry consulted with representatives of interested agricultural colleges and institutes as to the state of our knowledge of the value of whole milk and separated milk for the production of both pork and bacon. The result of the discussion was a general agreement that further inquiries were desirable, preferably of a co-operative nature.*

A scheme of co-operative experiments was accordingly devised, and has since been carried out at four centres—the Harper Adams Agricultural College, the Midland Agricultural College, the Monmouthshire Farm Institute, and the Hampshire Farm Institute. The following report on the combined results of those experiments has been prepared by Dr. Charles Crowther.]

IN recent years the problem of the disposal of surplus milk has periodically compelled the serious attention of dairy farmers, and emphasized the need for reliable guidance as to the economics of various alternative methods of disposal on the farm. Of these alternatives, the most familiar are butter-making combined with calf-rearing on separated milk, and cheese-making combined with the feeding of whey to pigs. On both these systems a considerable amount of useful information is already available, and it is usually not difficult to give reliable advice as to their economic possibilities. On many dairy farms, however, for various reasons neither of these systems can conveniently be adopted in its entirety. In some cases, although cream- or butter-production might be practicable, the disposal of the skim or separated milk by calf-rearing is not feasible, whilst in other cases the solution can only lie in some system of direct utilization of the surplus whole milk as such. For such farms, the feeding of whole or separated milk to pigs offers a possible solution, and reports have appeared from time to time in the agricultural Press of apparently profitable experiences in this direction. The information available, however, is conflicting, and indeed very meagre in so far as evidence from carefully controlled experiments is concerned. The practical importance of the problem made it obviously desirable that some authoritative guidance should be obtained, and, as the outcome of a conference of representatives of agricultural colleges and institutes held at

the Ministry of Agriculture on April 27, 1928, a scheme of experiments was drafted which has subsequently been tested at four centres, with results which are summarized below.

The scheme was designed to suit more particularly the case of the average farm, on which pig-keeping could only be undertaken to a moderate extent and under simple conditions of feeding. For these reasons a standard allowance of ½ gal. of milk per head per day was adopted throughout, to be fed along with a mixture of one-third sharps and two-thirds barley meal. This plain cereal mixture was used as the "basal ration," rather than as a "balanced" mixture, as it was considered that the addition of milk would give an adequate "balance" and eliminate the necessity for the purchase of expensive balancing foods of the meat meal, etc., class.

The scheme of experiment was as follows :—

(1) Selection and Number of Lots.—At every centre where the experiment is undertaken, not less than two lots of pigs (hereinafter referred to as Lots A and B) shall be selected, but it shall be optional for each experimenter to add one or two additional lots (hereinafter referred to as Lots C and D).

The desirable number of pigs to constitute each lot shall be regarded as 10, and in no case shall the number be less than 8 per lot. The age of the pigs when selected shall be approximately 10 weeks, and in all other respects, *e.g.*, size, breed, distribution of sex, the lots shall be as uniform as possible.

(2) Treatment of Each Lot.—In all respects, except in regard to the rations fed, the treatment and housing of the lots shall be as nearly as possible identical. It is not necessary—indeed it may not be desirable—that each lot shall be housed in one sty, but it is important that any division adopted shall be made to apply equally to each lot.

If worming of the pigs is thought necessary, it should be done before the commencement of the experiment.

(3) Rations.—*Lot A* shall, in all cases, be the Control, and shall be given a basal ration consisting of ⅓rd sharps and ⅔rds barley, per pig.

Lot B shall, in all cases, be fed with the basal ration fed to Lot A, plus ½ gal. (reckoned as 5 lb.) of whole milk, per pig daily.

Lot C (optional) shall be fed with the basal ration plus extracted soya bean meal (12 per cent.).

Lot D (optional) shall be fed with the basal ration, plus ½ gal. of separated milk.

Each lot shall receive also mineral mixture (two parts ground limestone, two parts steamed bone flour, one part salt) at the rate of 3 per cent. of the meal fed.

About 1 lb. per head of green-stuff must be given daily to each lot; a little small coal or ashes may be given occasionally, if desired.

A record shall be kept showing whether morning or evening milk has been fed. Where the milk has been pasteurized the temperature of pasteurization should be noted.

Immediately the lots have been selected they should be placed on the experimental rations for about a week before the actual commencement of the experiment, in order to give the pigs time to settle down.

(4) Mode of Feeding.—The meals shall be mixed with water at the rate of roughly 4 lb. of water per lb. of meal at the outset, the proportion being reduced periodically to about 3 : 1 at the end of the experiment. In the case of experimental Lots B and D, the milk should be mixed with the meals, and water added to give a similar consistency to that of Control Lot A.

Pigs shall be fed twice daily and given at each meal just as much of the prepared slop as they will clean up within the hour. The careful assessment of this quantity is an important factor in the success of the experiment. The periodic increases in the milk ration will be determined by the appetite of the pigs.

A careful record of food consumed must be kept. The slop should be prepared from day to day.

(5) Weighing.—At the end of the week immediately preceding the commencement of the experiment each pig shall be weighed on three consecutive mornings before feeding, the mean of the three weights to represent the weight at the commencement of the experiment, and the date of commencement to be taken as the second of the above three days.

The pigs shall then be weighed periodically, weekly if possible, on the same day of the week as the middle day of the three initial weighings. All weighings shall be made at the same time in the morning before feeding, and weights should be taken to the nearest ¼ lb.

(6) Disposal of Pigs.—Each pig shall be disposed of either for pork at or about the live weight of 100 lb. or 140 lb., or for bacon at or about the live weight of 220 lb., and the price obtained noted.

At each centre the pigs must either all go for pork or all for bacon. Where the pigs go for pork all should go either at or about 100 lb. or about 140 lb. and not some at the one weight and the rest at the other. Carcass weight (inclusive of head, feet and edible offal) as at 24 hours after slaughter must be ascertained to the nearest ¼ lb. for each pig. If weighed immediately following slaughter, a deduction of 5 per cent. must be made.

(7) Deaths or Illness of Pigs during Experiment.—In the event of any pigs dying during the experiment, a note of the date of death, and the undressed weight at time of death, should be taken and included in the records.

If it should be necessary, owing to illness, to remove a pig temporarily from a lot, the period of such removal, and the live weights on removal and on return, must be noted.

When from any cause the number of pigs in a lot is reduced the ration should be reduced in proportion.

(8) Assessment of Results.—(*a*) *Initial Value of Pig.*—If pigs are purchased, the actual cost should be taken. If reared, and cost records are not available, a standard value of 27s. for 10 weeks old pigs should be assumed. The basis adopted should be noted in the report.

(*b*) *Labour.*—2d. per week per pig should be charged.

(*c*) *Cost of Meals.*—This should be returned at cost on the farm.

(9) Report on Experiment.—Each centre shall furnish the Ministry with a report at the end of the experiment. These reports will be referred to Dr. Crowther, who will prepare a report on the combined results.

Experiments in accordance with the foregoing scheme have been carried out at the following centres :—

Harper Adams Agricultural College (Dr. C. Crowther and Mr. J. Fullerton), four lots (A, B, C, D).

Midland Agricultural College (Mr. H. G. Robinson), three lots (A, B, C).

Hampshire Farm Institute, Sparsholt (Mr. J. M. Templeton), three lots (A, B, D).

Monmouthshire Agricultural Institution, Usk (Mr. G. H. Purvis), three lots (A, B, D).

In the Monmouthshire Test the pigs were sold as porkers, whereas in the other three cases they went out at bacon weights. The initial weights differed considerably, however, at these three centres, the average per pig being roughly 38 lb. at Harper Adams College, 82 lb. at Sparsholt, and 95 lb. at the Midland College. This factor will obviously need to be taken into account in comparing the results. There were differences also in the type of pig used, as will appear in the reports on the various tests.

In order to assess the values realized for the whole milk and separated milk respectively, the cost of the sharps, barley and minerals consumed and of the labour (taken at 2d. per pig per week) is deducted from the total receipts for the pigs when sold. All other costs, including initial value of pigs, are the same for each lot and therefore need not be considered.

From the balance over "cost" thus arrived at any balance obtained in the same way with the Control Lot (Lot A) is deducted, and the final figure thus obtained represents the value realized for the quantity of milk consumed.

Monmouthshire Test.—In this test, carried out in June and July, 1928, three lots of eight pigs each (six Middle White and two Large Black x Large White) were used, the pigs being drawn from four litters, differing in age by 20 days. The average age at the commencement of the experiment was 11 weeks, and the pigs were then valued at 25s. each. All the pigs were disposed of locally for pork, the carcass weight being taken 24 hours after slaughter. The average period of feeding was 64 days in the case of each lot.

The feeding and management of the three lots was exactly in accordance with that provided for Lots A, B and D of the standard scheme, *i.e.*, Control Lot, Whole Milk Lot and Separated Milk Lot. The weight of meals fed to each lot was the same, the average cost of the mixture being £10 12s. 7d. per ton. All the milk fed was morning milk, given in perfectly fresh condition. The price realized on sale was 9d. per lb. dressed carcass weight (= 15s. per score lb.).

The essential features of the results are summarized below:—

	Lot A (Control)	*Lot B (Whole milk)*	*Lot D (Separated milk)*
Initial weight per pig (average) ..	45·5 lb.	44·6 lb.	43·5 lb.
Final live weight per pig (average) ..	94·4 ,,	124·3 ,,	115·5 ,,
Gain in live weight in 64 days ..	48·9 ,,	79·7 ,,	72·0 ,,
,, ,, ,, average per day	0·76 ,,	1·24 ,,	1·13 ,,
Average carcass weight, as percentage of live weight	67·81 p.c.	73·64 p.c.	72·62 p.c.
Cost of meals fed, per pig	23s. 0½d.	23s. 0½d.	23s. 0½d.
Milk consumed, average per pig ..	—	31·75 gal.	31·75 gal.
Realized for pork, per pig	48s. 0d.	68s. 7½d.	62s. 11d.
Cost of labour, per pig	1s. 6½d.	1s. 6½d.	1s. 6½d.

SUMMARY

	s.	d.
Lot A.—Value realized, per pig..	48	0
Cost of meals and labour	24	7
Balance, per pig	23	5
Lot B.—Value realized, per pig	68	7½
Cost of meals and labour (as above)..	24	7
Balance, per pig	44	0½
Deduct balance obtained with Lot A (above) ..	23	5
Net return from 31·75 gal. whole milk	20	7½
Return per gallon of Whole Milk	7·794d.	
Lot D.—Value realized, per pig..	62	11
Cost of meals and labour (as above)..	24	7
Balance, per pig	38	4
Deduct balance obtained with Lot A (above) ..	23	5
Net return from 31·75 gal. Separated Milk ..	14	11
Return per gallon of Separated Milk	5·634d.	

In the separate report on this experiment the comment is made that "while the new milk pen made the greatest apparent progress early in the experiment, those pigs fed on the separated milk, although not attaining the "bloom" of the pigs in Pen B, produced rather firmer flesh with a better distribution of lean with fat."

Briefly summarized, the value realized in this experiment for the production of pork at 15s. per score, with a meal mixture at about £10 12s. per ton, was approximately 7¾d. per gallon for whole milk and 5⅔d. per gallon for separated milk. These values will naturally vary proportionately with the price per lb., stone or score realized. Thus, at 16s. per score (the price taken in assessing the results of the other experiments) the values realized would have been one-fifteenth

higher, 8·31d. per gallon for whole milk and 6·01d. per gallon for separated milk.

It may be noted that Lot A, although not receiving milk, took only the same amount of food as the other two lots. One would have expected them to consume rather more, but the report on the experiment explicitly states that the pigs were given at each meal "just as much of the prepared slop as they could clean up within the hour."

It is of interest to note that in the Harper Adams experiment dealt with later the results obtained over a range of growth comparable with that of the Monmouthshire pigs agreed very closely with the latter, the average growth rates for the nine-week period being 0·70 lb., 1·22 lb. and 1·07 lb. per pig per day for Lots A, B and C respectively. These lead to almost precisely the same financial results as those given above.

Sparsholt Experiment.—In this experiment, carried out from November, 1928, to January, 1929, three lots (A, B and D) of eight pigs each were used. The pigs were all sired by the same Large White Boar, partly out of Large White sows and partly from Large Blacks.

The pigs are reported as averaging about 14 weeks old at the commencement of the experiment, but as the average live-weight at that stage was about 82 lb., a rather higher average age would seem probable.

The milk used was all from the morning milking and was fed in fresh, sweet condition. The price of the meal mixture used averaged £9 7s. 0d. per ton, no charge being made for grinding the barley.

The first draft of fat pigs was sold on December 27, comprising one pig from Lot A, four pigs from Lot B and three pigs from Lot D. The remaining pigs from Lots B and D, and one pig from Lot A, were sold on January 14, 1929. A third pig from Lot A was sold on January 28 and a fourth on February 14, but the remainder were barely up to the prescribed bacon weights on March 21, the date of the last weighing recorded. In this connexion Mr. Templeton remarks that "the health of all the pigs was good throughout, but when the extreme cold set in in January those pigs remaining in Lot A made very slow progress. . . . Owing to the severe weather experienced in January and February, I would suggest that the experiment be terminated at the end of the twelfth week, viz., January 11." At that period, Lots B and D were all cleared up and therefore did not experience the severe weather which accompanied the finishing stages of the pigs in Lot A.

This suggestion has the disadvantage of necessitating a valuation of the pigs in Lot A which remained unsold on January 11, but it would seem to be the best solution of the difficulty, and has been adopted below in assessing the results.

The selling price of the pigs varied considerably, but 16s. per score dead weight may be taken as the average price realized.

The essential features of the results are summarized below:—

	Lot A (Control)	*Lot B (Whole milk)*	*Lot D (Separated milk)*
Average feeding period per pig, days	82·2	78·75	80·5
Initial live weight per pig (average)	77·75 lb.	85·75 lb.	81·75 lb.
Final live weight per pig (average) .	166·62 ,,	219·5 ,,	212·0 ,,
Average gain in live weight per day	1·08 ,,	1·70 ,,	1·62 ,,
Average carcass weight	116·4 ,,	160·75 ,,	155·25 ,,
Cost of meals fed, per pig	39s. 5½d.	38s. 10½d.	39s. 3½d.
Milk consumed, per pig	—	39·25 gal.	40·3 gal.
Final value for bacon, per pig, at 16s. per score	93s. 1½d.	128s. 7d.	124s. 2½d.
Cost of labour, per pig	1s. 11½d.	1s. 10½d.	1s. 11d.

SUMMARY

	s.	d.
Lot A.—Final value, per pig*	93	1½
Cost of meals and labour	41	5
Balance, per pig	51	8½
Lot B.—Value realized, per pig..	128	7
Cost of meals and labour	40	9
Balance, per pig	87	10
Deduct balance obtained with meals, Lot A (above)	51	8½
Net return from 39¼ gal. Whole Milk	36	1½
Return per gallon of Whole Milk	11·1d.	
Lot D.—Value realized, per pig	124	2½
Cost of meals and labour	41	2½
Balance, per pig	83	0
Deduct balance obtained with meals, Lot A (above)	51	8½
Net return from 40·3 gal. Separated Milk	31	3½
Return per gallon Separated Milk	9·3d.	

* For Lot A, two pigs taken at actual carcass weights, rest at estimated carcass weights taken from standard live and dead weight table of East Anglian Pig Recording Scheme.

In considering the results of this experiment it must be remembered that they are affected by an element of uncertainty, owing to most of the pigs of Lot A not having been finished and sold by the date taken as the close of the experiment. The degree of reliability of the estimate of the final value of these pigs cannot be checked, but the error, if any, is probably

only small and unlikely to affect the final results for the value of the milk by more than about ½d. per gallon either way.

On comparing the initial live weights of the individual pigs, Lot B (Whole Milk) would seem to have started with a little advantage, and Lot A (Control) with a little disadvantage from the point of view of uniformity. The range of variation amongst the individual pigs is shown below.

	Initial Live Weights	
	Average.	*Range of Variation.*
	lb.	lb. lb.
Lot A	77·75	59–104
Lot B	85·75	77–103
Lot D	81·75	66– 98

The tendency of these inequalities would be to exaggerate slightly the final results for the milk values realized.

Midland College Experiment.—In this experiment, carried out, May to August, 1928, three lots (A, B and C) of eight pigs each were used. The pigs were from Middle White sows by a Tamworth boar, and averaged about 95 lb. live weight each at the start of the experiment, with an extreme range from 77 lb. to 117 lb. The whole milk used for Lot B contained on the average about 3·6 per cent. of fat, and was fed in sweet condition.

Details of the experiment were in accordance with the standard scheme, Lot A receiving the Control ration, Lot B the Control ration plus Whole Milk, and Lot C the Control ration plus Extracted Soya Meal.

The pigs were sold at a uniform price of 16s. per score dead weight. There was no significant difference in average carcass percentage between the three groups.

The essential features of the results are summarized below:—

	Lot A	*Lot B*	*Lot C*
Average feeding period, per pig, days	85·5	80·1	82
Initial live weight, per pig (average)	94·4 lb.	93·8 lb.	96·9 lb.
Final live weight, per pig (average) .	214·3 ,,	226·3 ,,	208·8 ,,
Average gain in live weight, per day	1·40 ,,	1·65 ,,	1·36 ,,
Average carcass weight	160·4 ,,	168·1 ,,	154·2 ,,
Cost of meals fed, per pig	40s. 7d.	39s. 7d.	40s. 3½d.
Milk consumed, per pig	—	40·06 gal.	—
Weight of soya meal consumed by Lot C, average, per pig	—	—	41·2
Realized, per pig	128s. 3½d.	134s. 6d.	123s. 4¾d.
Cost of labour, per pig	2s. 0½d.	1s. 11d.	1s. 11½d.

SUMMARY

	s.	d.
Lot A.—Value realized, per pig	128	3½
Cost of meals and labour	42	7½
Balance, per pig	85	8

	s.	d.
Lot B.—Value realized, per pig..	134	6
Cost of meals and labour	41	6
Balance, per pig	93	0
Deduct balance obtained with meals alone (Lot A)	85	8
Net return from 40·06 gal. Whole Milk	7	4
Return, per gallon, Whole Milk	2·19d.	
Lot C.—Value realized, per pig	123	4¾
Cost (barley, sharps, minerals and labour)	37	5½
Balance, per pig	85	11¼
Deduct balance obtained without Soya Meal ..	85	8
Net return from 41·2 lb. Soya Meal	0	3¼
Return, per cwt. of Soya Meal	8·8d.	

The results of this experiment are in very sharp contrast to those of the Sparsholt experiment, to which it is closely comparable as regards the initial weight of the pigs and the length of the feeding period. This is accounted for by the surprisingly high rate of growth registered by Lot A. In the writer's experience it is very rare, over the range of feeding here in question (90-220 lb. live weight), to secure an average growth-rate appreciably higher than 1·0 lb. per day on a ration of barley meal, sharps and minerals. It will be noted that in the Sparsholt experiment the average gain per day for the Control Lot was 1·08 lb. and in the Harper Adams experiment over a comparable period the average was 1·05 lb. per day. We can hardly resist the conclusion, therefore, that in the Midland College experiment some abnormal factor must have been operative in the case of Lot A, which has defeated the object of ascertaining a reliable figure for the value of the whole milk fed to Lot B. The explanation may possibly lie in the fact that up to the start of the experiment all the pigs had been receiving separated milk and whey along with a balanced ration of meals, including soya meal. It is not unlikely that a preliminary benefit was thereby secured, the effects of which persisted throughout the subsequent feeding period. This view receives some support from the close resemblance between the performances of Lots A and C, and deserves further study.

Harper Adams College Experiment.—In this experiment, the most comprehensive of the series, all the four lots of the standard scheme were included, and the feeding period was more prolonged owing to the lower initial weights at which the experiment was started.

The pigs used, 10 per lot, were all Large Whites bred at the

Experimental Station, and averaged about 12 weeks old at the start. The pigs in each lot showed a rather considerable range in initial weight, but the following data indicate that the lots were fairly well matched in this respect.

	Live weight per pig	
	Average.	*Range.*
	lb.	lb. lb.
Lot A	37·43	23 –52½
Lot B	38·30	23¾–55½
Lot C	37·57	27½–50
Lot D	37·50	28¼–50

All details of feeding and management were strictly in accordance with the standard scheme. The whole milk and separated milk used came from the morning milking, and were fed in fresh condition.

The experiment commenced on July 17, 1928, and was continued for 28 weeks, at the end of which time all the pigs in Lot C had been sold, four pigs from Lot A, nine pigs from Lot B and eight pigs from Lot D. In calculating the results the values of the nine pigs remaining unsold at the close of the experiment have been assessed on the basis of the standard table of live and dead weights of the East Anglian Pig Recording Scheme.

As was to be expected, the pigs of Lot A lagged behind the rest from the start, but for some reason which could not be diagnosed the two milk lots (B and D) did not make quite the rate of growth which was expected, as the long duration of the experiment clearly indicates. In order to simplify marketing some of the pigs were brought to appreciably higher weights than the 220 lb. suggested in the standard scheme. The prices realized per score varied somewhat, but an average price of 16s. per score has been taken in the following tables.

The essential features of the results are summarized below:—

	Lot A	*Lot B*	*Lot C*	*Lot D*
Aver. feeding period, per pig, days	196	168	189	180·6
Initial live wt., aver., per pig	37·43 lb.	38·3 lb.	37·57 lb.	37·6 lb.
Final live wt., aver., pr. pig	208.82 ,,	248·32 ,,	252·37 ,,	230·68 ,,
Aver. gain in live wt., pr. day	0·88 ,,	1·25 ,,	1·14 ,,	1·07 ,,
Average carcass weight	150·9 ,,	188·4 ,,	192·4 ,,	183·6 ,,
Cost of basal ration, pr. pig	79s. 7d.	63s. 4d.	78s. 8d.	73s. 6d.
Milk consumed, per pig	—	83·75 gal.	—	91·45 gal.
Wt. of soya meal consumed by Lot C, aver., pr. pig	—	—	97·65 lb.	—
Realized, per pig	120s. 9d.	150s. 9d.	153s. 11d.	146s. 11d.
Cost of labour, per pig	4s. 8d.	4s. 0d.	4s. 6d.	4s. 4d.

SUMMARY

	s.	d.
Lot A.—Value realized, per pig	120	9
Cost of meals and labour	84	3
Balance, per pig	36	6
Lot B.—Value realized, per pig	150	9
Cost of meals and labour	67	4
Balance, per pig	83	5
Deduct balance obtained with meals alone (Lot A)	36	6
Net return for 83·75 gal. Whole Milk	46	11
Return per gallon Whole Milk	6·72d.	
Lot C.—Value realized, per pig	153	11
Cost (basal ration and labour)	83	2
Balance, per pig	70	9
Deduct balance obtained without Soya Meal (Lot A)	36	6
Net return from 97·65 lb. Soya Meal	34	3
Return per cwt. Soya Meal	39	3
Lot D.—Value realized, per pig	146	11
Cost of meals and labour	77	10
Balance, per pig	69	1
Deduct balance obtained with meals alone (Lot A)	36	6
Net return for 91·45 gal. Separated Milk	32	7
Return, per gallon Separated Milk	4·28d.	

The returns both for whole milk and for separated milk come out much lower in this experiment than in the Sparsholt experiment, but this is explained by the much lower rate of growth. It should be remembered also that the Harper Adams experiment covered a much longer period of growth, the average weights per pig being lower at the start and higher at the finish than in the Sparsholt experiment. For the period of growth comparable with that covered by the latter the average daily gains in live weight (per pig) were 1·35 lb. in Lot B and 1·18 lb. in Lot D. Both experiments agree, however, in indicating that the value per gallon realizable with separated milk falls but little short of that realizable with whole milk, a conclusion with which also the Monmouthshire pork production figures are in harmony.

The soya meal in the Harper Adams experiment (cost £10 16s. 0d. per ton) showed a very handsome profit.

Summary.—The results of the four experiments here summarized will effectively dispose of any idea that for any given combination of food prices and carcass values it is possible to give a fixed value to either whole or separated milk for pig-feeding, since the return is so greatly influenced by the rate of growth obtained, this varying with the type of pig, housing, management and other necessarily variable factors.

This is well illustrated in the results of the Sparsholt and Harper Adams experiments, the two most nearly comparable experiments of the series. In the former, with an average growth-rate of 1·70 lb. per day, the return per gallon of whole milk was 11·1d. per day; and with separated milk a return of 9·3d. per gallon on an average growth-rate of 1·62 lb. per day. In the Harper Adams experiment, over the same range of growth the average growth-rates secured were only 1·35 lb. and 1·18 lb. respectively, resulting in the correspondingly lower returns per gallon of 6·7d. for whole milk and 4·3d. for separated milk. These latter results can perhaps be regarded as minima, since the growth-rates are certainly below those commonly attained in milk feeding.

For reasons given above the Midland College experiment must be regarded as abnormal, and can hardly be brought into comparison with the rest.

As far as bacon production is concerned, therefore, under the conditions of the experiment, with a cereal ration costing in round figures 10s. per cwt., and bacon pigs realizing about 16s. per score dead weight, a return of from 7d. to 11d. per gallon for whole milk, and of 4½d. to 9d. per gallon for separated milk, may be expected, the actual value realized between these limits turning primarily upon the rate of growth secured. The range of variation indicated is unfortunately too great to furnish any very definite practical guidance, but it can only be defined more narrowly by repetition of the experiments on a greatly extended scale.

The Monmouthshire experiments, being restricted to pork production, stand alone in the series and cannot be compared directly with the rest, but it is of interest to note that the results fall intermediately within the range above indicated, and thus harmonize with the general conclusion drawn, as do the Harper Adams figures for the same range of growth.

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AGRICULTURAL EDUCATION IN CHESHIRE:

A TEN YEARS' RETROSPECT

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". . . . . each in his separate star,
Shall draw the thing as he sees it,
For the God of things as they are."

THE Cheshire School of Agriculture owes its inception in part to historical considerations and in part to the stimulus of the farm institute campaign with which the name of Sir Daniel Hall is associated. Agricultural education has had rather a long history in Cheshire, thanks to the activities of local landowners and other public-spirited people; there was a school of dairying at Worleston before the passing of the Local Government Act in 1889, and the County Council, ever since its formation, has devoted unremitting attention to the subject. Under the Council's ægis, Worleston was enlarged and an institution which grew into Holmes Chapel Agricultural College was founded. Other public bodies, notably the Chamber of Agriculture and the Cheshire Milk Producers' Association, had also interested themselves in educational measures. Various considerations dictated a new campaign at the end of the War, for Holmes Chapel had not survived the withdrawal of students for War service; Worleston was becoming out of date in buildings and equipment, and other activities were felt to be too scattered.

In 1918, on the death of the owner, the Reaseheath estate was offered to the authority, and proved on examination to be singularly suitable for the purpose in view, comprising a country mansion standing in beautiful grounds, with a home farm of more than 200 acres, extensive outbuildings suitable for conversion into laboratories and classrooms, a small detached farm and a hamlet containing 14 cottages, the whole situated in the heart of the dairying area, and readily accessible either by road or rail. It was, therefore, purchased and its development proceeded with; male students being admitted from 1921 onwards.

Experience at Worleston had shown that there was an all-the-year-round demand for dairying instruction—the demand being, indeed, heaviest in the winter time—so that a

scheme which provided for men only in the winter and women only in the summer would not be satisfactory. Provision for co-education was inevitable, if the desired concentration of effort was to be achieved. Owing to various causes, chief among which were financial considerations, it was not possible to proceed with the buildings necessary to accommodate women students for some years; but eventually a hostel and a large teaching dairy were erected, the farm buildings were remodelled and the institution, now fully established, was opened by H.R.H. The Prince of Wales in the autumn of 1926.

Development thus occupied a period of seven years, or, if the first three years of completed life be reckoned as an experimental period, of ten years in all. The main lines upon which development must proceed were evident from the commencement, but as the gradual development has allowed of constant review and reconsideration of original conceptions, in the light of experience gained, it seems opportune at this point to offer a few general observations on county agricultural education.

The Purpose of a County Centre.—The purpose of a county centre may be defined broadly as that of furthering the industry by educational means.

Fundamentally its duties towards resident students and towards farmers are the same, although the means whereby these functions are performed—teaching and advisory work respectively—are necessarily different. Both hang ultimately on the extent to which the central institution functions as an intellectual centre. The mere facts disseminated have, of course, considerable value, particularly in the case of students; but, even in this case, it has to be recognized that many of these facts could equally well be acquired elsewhere—many of them are, indeed, regularly handed on from father to son on good farms. What is of much greater importance is the cultivation, both in students and in practical farmers, of a scientific outlook—an outlook which insists on precision, orderly arrangement of facts, and logical deduction therefrom: an outlook which regards knowledge as an end in itself. The agricultural world is based on a theory and practice of life which consists of work and sleep—from which conception, incidentally, nearly all our economic difficulties spring. The fundamental business of an educational centre is to create an atmosphere, to invest labour with the glamour of intellectual treatment, to subject practice to scientific analysis.

The Aim of the Trading Departments.—To elaborate this theme it is necessary—or, at any rate, helpful—to turn to the farm, or to some other trading unit, since from this the institution as a whole will take its tone. The policy of the farm will dictate the nature of the teaching and of the advisory work. We assume at the outset that the students—or, at all events, a goodly proportion of them—will be either sons of farmers, or young people taking up practical work on the farm for a livelihood. In the past, the question of their education has been discussed chiefly from the viewpoint of what they may be considered to need. It is more helpful, however, to a teacher to consider it from the viewpoint of what he is in a position to teach them—to ask himself what special advantages, if any, he has over other farmers who for generations untold have brought up their sons and daughters in the ways of agriculture!

Farm Management.—The answer depends very much on his attitude to the farm. The ideal to be aimed at is a farm in the management of which every material fact established by science is utilized, and from which every material economic fact can be gained. This implies a clear-cut purpose in every step taken, careful and laborious recording of results, and a fearless facing of the facts when collected. Common honesty and courage are among the first attributes of a teacher, for it should be observed that failures are bound to come. No scientific worker expects all his experiments to "come off." Klebahn used to tell his students that he was content if 10 per cent. of his experiments were successful. Unfortunately for us, our work has to be performed beneath the gaze of a public which demands a nut for every shy. It is so pitifully easy for critics to hold up to scorn unsuccessful efforts, to dismiss them sweepingly as due to "mismanagement." Rightly used "failures" may prove more valuable than successes: but it requires some courage to own to them at all.

If one reviews a farming year and all the operations contemplated, it is gratifying—at any rate to anyone with personal associations in agricultural education—to see at how many points agricultural science and practice make contact. To the scores of questions which arise in the course of a year's work, some answer at any rate is to be found in the pages of recorded research or experiment—often the evidence is imperfect, but there is evidence of some sort. Oddly balanced, however, one finds the volume of the book is here a wealth

of information on some point of relatively little economic consequence, there a yawning gap. On Reaseheath farm, about £100 a year is spent on artificial manures, and literature to guide one in the spending of that sum pours in in a steady tide to join the sea already accumulated; meantime, one searches literature in vain for experimental evidence which will tell one how to rear dairy cattle or to dispel that shadow of disease which broods perpetually over every stock farm.

Much of the information needs checking, or adding to, by local trials, but take it for all in all, it amounts to a goodly heritage.

Parenthetically, one gains from such a review a wholesome respect for empirical work; and one rises with the prayer that some day funds, commensurate with our needs, will be available for investigations on animal diseases.

When, however, one turns from consideration of the programme projected to that of the probable financial results, one is in a very different position. Agricultural science can contribute nothing beyond the scanty conclusions on internal economics derived from surveys and cost accounting, and the general principles set forth in text books and market reports concerning the larger or external issues. As regards information, the teacher is no better off than every other farmer—indeed, he is generally not so well off, for farmers have the traditional knowledge of their area which, even if unreliable, is better than nothing.

Towards the economic issues, therefore, but one attitude is possible—that of the student. One must be content to learn as one goes; to set a course, using such guides and landmarks as one has, adhere as far as may be to it, record the results faithfully, be they good or bad, and endeavour to learn therefrom. In so doing, one is but following those trial-and-error methods by which practically all human progress has been achieved, and if scientific precedent be sought, is it not found in the use of the working hypothesis?

Cost accounting is valuable as a check; indeed, economic study, whether internal, or external, is impossible without such aid. It is subject, however, to many limitations. Crude conventions in allocation of changes become absorbed into a system, and with usage tend to become accepted as facts; the whole principle of allocation of labour at fixed charges per hour or per day is of doubtful applicability to a stock farm. It is impossible, for instance, to give mathematical value to a good stockman's service. Is it not traditional that

the master's eye fattens cattle? On a teaching farm, it is difficult to give due weight to such abnormal charges as management, demonstration costs, and so on. All these facts notwithstanding, cost accounting is one of the first requisites in a study of the economy of the farm.

Of even greater consequence are the field and stock records used in cost accounting. British agriculture is sadly lacking in reliable statistics; few farms have the means of making records. For many years to come almost any records of performance which can be taken on a farm—be they yields of crops, rates of growth, numbers of progeny, incidence of disease, or what not—will be of value both on the farms where they are made and as material for study of principles. Agricultural science in the past has relied almost entirely on the experimental method of pursuing inquiries; we are in danger of forgetting that another equally reliable method, the statistical, is open to us.

One must be prepared, by such methods, to reach conclusions somewhat at variance with those of controlled experiments. In controlled experiments, every effort is made to rule out disturbing factors in order that the effect of the factor under study may be revealed; in consequence the result, though true for those particular circumstances, may not be obtainable in practice. It is a relative result. In practice it is only the absolute result which counts. Thus, everyone takes small groups of selected pigs for feeding trials; but, working in practice with large groups of mixed animals, it is futile to look for the same absolute results, although the relative results may be similar. The gospel of the average has to be learned and relearned in practice.

Again, one is likely to discover by such methods unsuspected gaps in our armour. Much attention has been given to feeding of dairy cows and to milk records; from the evidence of scientific works the conclusion seems irresistible that the high-yielding cow is the most profitable. Again, however, the evidence is imperfect. It is not possible to discuss an economic question of this kind without consideration of the sale price of milk, capital cost of the cow, rate of depreciation and so forth. In some circumstances the handsome, high-yielding cow is an expensive luxury.

One writes of the ideal to be aimed at on the farm; it is not to be supposed that this ideal can in fact be attained. There are conflicting factors. It is difficult entirely to escape the "show" farm atmosphere. What man who loves the land

and all its works can resist the temptation to grow "something for folks to see"; who that lives much amongst livestock can subordinate all æsthetic sense to economics? In addition, personal aspects apart, there is always the propaganda side to consider. There are hosts of men, good solid farmers, too, who will be more impressed by a big wheat crop or a fine-looking herd of cattle than by the most erudite teaching. A sop to Cerberus seems justifiable. One of the first principles in teaching is to get oneself listened to. Even St. Paul, greatest of teachers, recognized the claims of expediency. A reasonably high standard of production is, in any event, forced upon one; a strictly commercial outlook on, say, clean milk production is unthinkable, even if the milk be used for cheesemaking.

On the vexed question of the net financial results of working the farm, it is difficult to write with confidence. That it is possible to run a farm to advantage educationally, and at the same time to show a net profit on the year's working, cannot be doubted, but whether any particular purpose is served thereby is another matter. The main purpose of the farm is information. The net financial results will obviously depend on existing market conditions for the main products; and one cannot limit the undertakings of a farm by the market conditions which happen to prevail in the particular area in which it is situated. Common sense and public duty alike suggest, however, that net deficits should be kept within reasonable limits.

The case of the farm has been discussed at length as it is much the largest trading section; but the principles set forth apply equally in all departments.

Students.—To turn next to the numbers and types of students applying for admission, an examination of the figures to date affords some explanation of the organization for teaching which has been adopted.

Cheshire is a county of small farms, worked in the main by family labour. It has been given over to dairy farming from time immemorial, although, with the rise of the great markets in Lancashire, potato growing has in modern times become a feature of the agriculture of the northern half. Children commence work at an early age, and, on leaving school, are immediately absorbed into the farm routine. Of late years, the size of the family, as everywhere else in England, has fallen considerably. There is a steady influx into the area of young men and women from the towns with or without capital. There can be no question that the demand for young men

to replace non-existent sons is growing and will grow. Cheese-making, though slowly declining, still offers an immense market for skilled work. Poultry keeping is visibly increasing. A liberal scheme of scholarships, offering residence and tuition free of cost or at reduced fees, is in existence. As a result of all these factors, one finds that there is a demand for special training in dairying, poultry keeping and horticulture, in addition to that for general agriculture. It has been necessary, therefore, to organize special courses of instruction in these subjects—an arrangement which happens to coincide with and justify commercial organization of four separate and semi-autonomous departments.

Attendances to date have been as follows (the figures for men being for 7 years, and those for women for 3 years only):—

	Farmers' Sons	*Farmers' Daughters*	*Other Males*	*Other Females*
Agriculture	72	—	115	—
Dairying	23	28	43	71
Poultry Keeping ..	3	1	44	20
Horticulture ..	5	—	28	7

The subsequent histories of students are not definitely known, but everyone has entered with the professed intention of taking up some form of practical agricultural work, and the vast majority are certainly so employed now. It cannot be doubted that the fruits of education are being carried to the land, but it is noteworthy that the majority of students are carrying them in the capacity of employees rather than of employers or potential employers. Such a result is natural enough in the case of the three "specialist" courses, and, as far as it goes, is a good sign; it means that education has a market value. The case of the agriculture course is different. At a liberal estimate, the proportion of farmers' children who have attended cannot amount to more than 5 per cent. of those who have in this period been of suitable age. To conclude that the farmers approve of education for their employees, but not for their own children, would be, as Dr. Crowther puts it, "pure nonsense." Some other explanation must be sought; and there would seem to be three possibilities.

(1) Unpleasant as it may be to write it, it is possible that farmers "have no use" for educationists and all their works. The evidence to the contrary—particularly the attitude of those farmers who have sent children in the past, and of the great number who, through advisory and other means, are known personally to the staff—is so overwhelmingly against this view that it can with confidence be dismissed.

(2) It is possible that, reared within the narrow round of a small farm, with no education beyond that of the elementary school, youths and girls fight shy of a residential institution. Unquestionably, this accounts in part for many absences.

(3) A third cause remains—the value of a son's or a daughter's labour. So far as can be determined, this is the chief deterrent. Over and over again it has been argued by parents applying for relief of fees that the son's attendance involves his absence from the farm and the engagement of an extra hand. It is difficult to convey to anyone unfamiliar with the life of a family farm the immense value of a son's or a daughter's labour. To argue that, at most, the child's education will not involve the cost of a heifer or a couple of sows, is futile. As an effort in mathematics the proposition may be true; but it does not really touch the point. A son's labour cannot be expressed entirely—in his parent's eyes, at any rate—in terms of money, and one cannot at present look for advanced views on finance in such matters. Success in family farming is achieved rather by not spending than by big returns on money spent.

With the passage of time, and the gradual growth of the idea of education for farmers' children, no doubt the numbers will grow. Meantime, development of propaganda work is clearly called for.

Curricula and Equipment.—Curricula for the ends in view have had to be evolved. The length and scope of the four courses have varied, but appear now to have settled down to suitable proportions.

Agriculture.—There are, as has been said, two farms. The larger farm is equipped and, in the main, managed as a normal dairy holding, with a herd of 60 commercial shorthorns—recruited in part by rearing and in part by purchase of Irish stock. There are two shippons or cowsheds, one equipped with a Gascoigne milking machine and automatic water-bowls, the other devoted to hand-milked stock. The piggeries provide accommodation for about 20 sows and 150 feeding animals, the equipment including provision for automatic feeding of whey. A good weighbridge forms one of the most useful articles of teaching equipment. Sheep husbandry is limited to early lamb production with flying flocks, and a certain amount of winter feeding of bought-in lambs. The 50 or 60 acres of arable land serve for the growth of forage crops, corn and a small area of potatoes.

The smaller farm, 50 acres in area, is used solely for experiments. Half arable and half grass, it allows of a trial of intensive management of grass land and supports a herd of 25 to 30 cows. The elimination of tuberculosis here constitutes the chief feature of herd management. A tower silo permits of the growth and storage of silage crops, while the remaining area of arable land is devoted to field plots of the usual type.

The agricultural course, to which, naturally, most attention has been given, presents by far the greatest difficulties. The object is to train men as managers of farms. At first glance this seems to call for some sort of practical training. The farming community asks, naturally enough, that the training shall be simple. In reality that demand is asking for the moon. The business of farming hangs in part on economic laws and in part on successful technique, which again hangs largely on appreciation of the principles of natural sciences. The only possible method of attack is to lead up to economic considerations through the principles underlying practice and actual technique.

This cannot be a simple programme. It is, indeed, a stiff programme for 20 weeks, with classes of men unpractised in the arts of the schoolroom, unfamiliar with abstract thought. The problem is simplified, however, by the fact that the staff is a small one. Cyclostyled notes made up in booklets covering each subject form the basis of classroom teaching, and incidentally serve as an exact delimitation of each teacher's province. Practical work on the farm is limited to disciplinary morning and evening duties amongst stock, and a long series of demonstrations on the farm serves the dual purpose of illustrating and relieving classroom work. Naturally, the basis of the teaching in technique and economics is the farm; as experience grows and records accumulate, it becomes possible to hinge teaching on actual practice to an extent which at the outset seemed unattainable.

Science, in the narrow, popular sense, is restricted to principles known to be needed in the teaching of technique. If, on the one hand, lack of academic learning—or, not to put too fine a point on it, lack of general education—in students presenting themselves for training is a severe handicap, it must be admitted that their attainments in other directions simplify the teachers' task. Many a lad, coming at 16 or 17 from a family farm, has a knowledge of stock farming processes and of trading principles which would put to shame some graduates. In general, men of 20 to 24 seem to make the fullest use of instruction provided—in part, no doubt, owing to a

greater stability and seriousness of purpose, but largely owing to their greater experience. Some of the holders of Ministry of Agriculture scholarships have illustrated this particularly.

As a result, the task of turning out a man equipped with the technical knowledge and outlook required by an up-to-date manager in the area, in the space of six months, falls within the bounds of possibility. Mr. Bond, reporting on the final examination last year, wrote :—

"The standard of attainment set by the best students was very praiseworthy. In the subject of practical agriculture, more than half of the candidates gained first-class marks, and they would be capable of making a creditable attempt at degree or diploma papers."

Poultry Keeping.—The poultry course provides a relatively simple problem. A small holding with two crofts, in the village of Reaseheath, formed the nucleus of the department, now extended by the inclusion of adjoining farm land to 10 acres or thereabouts. This has been equipped with modern plant, the outbuildings converted to form incubator rooms, plucking houses, and so forth, and the farm stocked with utility breeds of fowls and ducks. A single-bird laying trial open to the county is also conducted. In 1923 Reaseheath was selected as the centre of the Northern Breeding Committee's experimental work on breeding for egg production, a site of 10 acres adjacent to the poultry farm being placed at their disposal, and the County Poultry Instructor being appointed honorary superintendent. Though not incorporated either in theory or practice in this department, it constitutes a valuable asset as a demonstration ground for students.

Students are, on the average, possessed of fair general education and, by a queer anomaly, are prepared to devote a longer period to learning the relatively narrow round of poultry husbandry than the agriculture students can devote to the vastly greater round of the farm. They differ from them also in the fact that few have any initial knowledge of practical work, and a mixed course of theory and practice, extending over a full academic year, has, therefore, been designed. This course qualifies for admission to the N.D.P. examination, and is, indeed, modelled largely on the published syllabus for that examination.

Poultry keeping is from a teacher's standpoint "a good subject." The varied nature of the work, the manifest value of detail, the relatively large volume of established facts, the

ease with which accurate information can be collected, and, finally, the enthusiasm which it appears to develop in every person who studies it—all these features help to make it an admirable subject wherewith to illustrate the application of science to practice.

Dairying.—The nature of the dairying course is determined mainly by the peculiar needs of the area. There is a great demand for skilled workers throughout south Cheshire and northern Shropshire, and ability to convert large volumes of milk into first-class Cheshire cheese is the chief requisite in a dairy hand, although, in recent years, developments in the technique of milk production have led to a demand for other qualifications also.

The dairy is a commodious building, equipped for handling a considerable quantity of milk, particularly for cheesemaking and in every section sufficient machinery has been introduced to teach students present-day possibilities of labour saving Most of the equipment, however, is of the hand type, and for the most part conditions of training are similar to those which obtain on the better cheesemaking farms of the area.

The cheesemaking process occupies so large a slice out of a working day, and the craft is withal so largely an art, that it is not possible to introduce much scientific training Nevertheless, something can be done in the direction of critical examination of processes, in exact measurement of results where means exist, and in the experimental study of methods of measurement where at present sensory standards only are known. The purely artificial nature of the end-product and the meaningless jargon of trade terms which has grown up around it, as well as the complexity of the material handled make this, however, a baffling problem.

Practical work is illustrated by short series of lectures on dairy chemistry and bacteriology, and a class in book-keeping is introduced. There are two courses in a year, each course covering 22 weeks.

Horticulture.—Horticulture offers a problem similar in many respects to agriculture. As a distinct industry, it does not figure very largely in local life, though there is a considerable area of market gardening near Manchester and again in Wirral while fruit-growing flourishes in isolated spots. It was however, clear from the outset that a demand existed for systematic training in this subject ; moreover, the possibilities of development of fruit growing in the area are considerable.

As the gardens offered distinct possibilities, steps were taken to enlarge and stock them as soon as the property was acquired. They now extend to over 10 acres, with separate sections devoted to fruit, market garden crops, flowers and eight glasshouses.

Many of the students who present themselves are unfamiliar with commercial gardening and are, accordingly, required to spend a preliminary period of twelve months at practical work alone before proceeding to the organized course, which extends over a full academic year. The profession calls for a very wide knowledge of technical facts—even wider perhaps than farming. On the scale in which horticulture is locally conducted, technique outweighs organization in importance. Fortunately, most of the technical facts can be acquired equally well in the garden and the classroom. There is, therefore, more continuity of training in the purely practical and organized courses than could be achieved in agriculture. The subject lends itself well, too, to training in the application of natural sciences, and it is possible, therefore, to design a logically connected curriculum in which due weight is given to the natural sciences and to technique.

General Agriculture.—It is not possible to separate the cultural aspects of a course of training from the instructional aspects, since the object in the design of all courses is to make them as cultural as possible. It is, however, pertinent to inquire, before leaving this branch of the subject, what influences of a refining and broadening nature, other than teaching, can be brought to bear. To anyone familiar with the influence of a good school, it will be obvious that mere residence in a disciplined institution, in an atmosphere predominantly intellectual, must exercise a considerable influence, especially on youngsters who have been reared in the more remote backwaters of life. Mere contact with other people of varied type begets a broader outlook and generates a sense of fellowship. These tendencies can be stimulated. At Reaseheath there is a Students' Union for the furtherance of social and athletic activities, a dancing class is held every winter, while concerts and social gatherings, occasional lectures on subjects of general interest, debates and so forth, relieve the tedium of study.

It is necessary to write here with caution. Six months of communal life cannot undo the effects of generations of isolation. Individualism is deeply ingrained in the British countryman. None the less, it is possible, even in six months, to develop in

some measure that cultural and corporate spirit which inspires and glorifies our schools.

Extra-Mural Work.—Every member of the school staff is available for county work; but as the forms which this has taken—lectures, demonstrations and personal visits—are identical with those which have been so extensively studied all over England, attention may be confined to the general aspect of linkage with internal work.

No single feature of our experience has been more striking than the contribution which the central institution has made to the scheme for extra-mural work. Experimental and other studies have come to form the basis of all external teaching; the fact that most of the advisers or lecturers are personally concerned with trading departments gives to their teaching a colour and tone scarcely attainable by other means, and the centralization of staff allows of free consultation and co-operation. It is remarkable how many of the varied problems of farming are common to all the farms in a district; comparatively rarely at Reaseheath are we presented with a problem on which no evidence is obtainable from our own departments. One exception should be made, however—noteworthy in itself and as an example of the public benefits which accrue from co-operation between an individual and an educational authority. The north-eastern corner of Cheshire is so different agriculturally from the rest of the county that an adviser with experience only of normal conditions would be ill placed to deal with the special problems of that area. In 1921, however, Mr. W. R. Reeves, farming a 70-acre holding near Stockport, obligingly placed his entire farm at our disposal for experimental purposes, and a long series of studies, by experiment and trial and error methods, has been conducted thereon. This farm has proved a mine of information and incidentally has demonstrated the use which some people can make of scientific advice and guidance.

The method of presentation of experimental results constituted for some years a difficult problem; bulletins, and leaflets in their baldness and limited range, did not make, even in the eyes of their authors, very attractive literature. They were not, moreover, suited to studies of the trial and error type. Three years ago, therefore, the idea was conceived of publishing a journal consisting of articles by various members of the staff, discussing general topics, in a comprehensive and readable manner, in the light of such experimental and other evidence as we had. Three volumes have now been published

under the title *The Reaseheath Review*. They have met with an excellent reception, and it is intended to continue publication annually. Receipts from advertisements—a regrettable necessity—permit of sufficient copies being issued to supply every farmer in the county.

In the various educational developments sketched, we have been fortunate in the active co-operation of the chief farmers' organizations in the area, particularly the county branch of the N.F.U. Most of the senior officers of the staff are members of one or other committee of the branch. Recently the chief dairy instructress has, by acting as their first "grader," rendered material assistance to the Cheshire Cheese Federation in its infancy. This arrangement is noteworthy as an example of a direction in which educationists can assist in a purely business matter, but still more noteworthy as an index of the confidence reposed in an educationist by informed farming opinion.

Women's Institutes have come to form a valuable connecting link between the education authority and the fairer portion of the rural community. A large number of lectures are given annually to these bodies, and in a number of instances special courses of instruction have been designed to meet their needs. From the standpoint of propaganda they are valuable organizations.

Another type of organization which has been fostered in co-operation with the N.F.U. is Young Farmers' Clubs. These are educational and social clubs, membership of which is open to farmers' sons and young farmers. As a rule they meet fortnightly in market towns for educational purposes during the winter months ; and during the summer a number of excursions, judging competitions, and so forth are held. Eleven such clubs have been formed in the county in the course of the last five years. They undoubtedly present immense possibilities in the development of progressive ideas, whether of production, marketing or social life. Nearly every member is in a position to undertake book-keeping, recording, experimental work, or at the least to apply directly and immediately the results of scientific teaching. Candour compels one to admit, however, that they do not always fulfil the prospects which their foundation promises. One or two clubs after a promising start have "fizzled out"; enthusiasm nearly always wanes after the first two years, and constant stimulation is necessary. It is greatly to be regretted that limitations of staff prohibit much time being devoted to them.

There are, however, limits to the work which a handful of people can do. Advisory work by means of personal visits has grown in the space of ten years to such proportions that fulfilment of all demands is out of the question. Competitions, shows, evening lectures, meetings, public demonstrations, experiments, succeed one another with bewildering rapidity. In season and out of season there are the demands of the central institution with its student roll of 70, its trading departments, its experiments and studies. Well may we say with Mr. Fips, "Plenty to do, plenty to do!"

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PRECAUTIONS TO BE TAKEN WHEN FILLING SILOS

THE accident at Manor House Farm, Stretton-under-Fosse, near Rugby, in June, in which Mr. W. T. Crofts, a prominent local farmer, and two farm workers lost their lives on entering a silo which had been partially filled, has doubtless given rise to apprehension in the minds of many who may be similarly engaged. The fatality, however, appears undoubtedly to have been the result of a combination of unusual circumstances, and if the precautions recommended below are taken no danger need arise from the use of silos.

Immediately after the coroner's inquest an inquiry was commenced into the circumstances of the fatality. The services of a representative of the School of Agriculture, Cambridge, and one of H.M. Engineering Inspectors of Factories were placed at the Ministry's disposal, and the substance of their reports is given below.

The silo in which the accident occurred was a cylindrical iron tower about 30 feet high and 12 feet in diameter. It was roofed at the top with an opening for ventilation and had two holes in the sloping sides of the roof, through one of which the blower tube entered during the process of filling. The other hole was left open during the operation. As is usual, there were doors up the side of the silo. The distance from the bottom of one door to the bottom of that immediately below it was 4 ft. 6 in. The only means of entrance was through the doors by means of a fixed iron ladder. The silo had been in use for four years and, so far as could be ascertained, no noxious gases had been noticed during that period. Before being used this year it had been cleaned and had received the customary coat of paint inside.

The forage which was being fed into the silo consisted of oats, vetches and a small quantity of beans. The crop had been grown on heavy land and was yielding a large quantity of fodder. Examination of the growing crop on June 20, seven days after the accident, did not reveal the presence of weeds or abnormal constituents, but the vetches were not quite in full flower, the beans were just beginning to blossom and the oats had not quite reached the flowering stage. Now the earliest stage of maturity at which such a crop should be cut for silage is when the oats are in full milk and the vetch pods are full grown in length, with seeds about half-formed. At this medium stage of maturity, the type of silage known as "green fruity" silage is obtained. The crop may be cut at a later stage, but not earlier. For example, the common "acid brown" silage is produced by cutting when the vetches are well seeded and the oats have passed the milky stage. It is important to note that the crop as cut in the present instance was very immature. On the other hand, the Ministry has learned that owing to the heavy crop this year other farmers have cut their tares for silage much earlier than usual and in a very green state.

The loading of the silo had been commenced on Tuesday, June 10, and had proceeded normally on the following day. On the Thursday, however, only four cartloads were fed to the silo, the last being at 3.30 p.m. There were then three doors of the silo closed and sealed, and the level of the crop was about one foot below the lowest open door. For the guidance of those with little practical acquaintance with silos, it should be explained that the doors open inwards and, as the crop reaches the top of a door, the door is sealed on the outside. This is an important point in connexion with precautions to be taken. During the Thursday night the level in the silo sank about 4 ft. 6 in., while the normal fall was stated to be 3 ft. Only four loads had been fed to the silo during the day, and if the treading had been less than usual the exceptional fall in the level would be explained.

The position on the morning of the tragedy, June 13, was that the level of the silo was about 5 ft. 6 in. below the bottom of the lowest open door, forming a well 5 ft. 6 in. deep, with no ventilation, in which the gaseous products of fermentation had collected.

With regard to the accident itself, it will be sufficient to say here that it would appear that the two farm workers entered the silo, as was their custom in the morning, to continue

treading the contents prior to commencing to fill the silo during the day. Mr. Crofts lost his life in an attempt to save them when their condition was brought to his notice.

The evidence given at the inquest and general considerations point to asphyxiation from carbonic acid poisoning as the cause of death. It is possible that other toxic gases besides carbon dioxide may have been evolved, but the symptoms described by witnesses are consistent with carbonic acid poisoning, and the presence of other gases cannot be assumed.

The main changes that take place during ensilage can be grouped under three headings :—

(a) **Respiration of Plant Tissues.**—This results in the breakdown of carbohydrate material into carbon dioxide and water (plus heat) when plenty of air is available. If, however, only a limited supply of air is present, oxidation is incomplete and a much smaller quantity of carbon dioxide is formed.

(b) **Enzyme Activity.**—This results in the splitting up of proteins into much simpler products.

(c) **Bacterial and Fungal Activity.**—These yield many products, but the chief changes are the production of organic acids, the partial breakdown of cellulose and, under certain circumstances, the putrefactive decomposition of nitrogenous material.

Any immaturity in the crop being fed to the silo on this occasion would favour the splitting up of carbohydrate and protein material. Further, the crop had been cut and had been allowed to wilt in the field for two days before it was fed into the silo. The weather conditions were hot and dry during the period, so that the material was very dry and would not have settled so compactly as unwilted material, and more air would be retained in the material as fed to the silo. A greater opportunity was thus afforded for a more complete oxidation of the carbohydrate material with the evolution of a larger volume of carbon dioxide. This process would be assisted if the material had not been well trodden over night. Moreover, the thundery conditions which prevailed during the night may have accelerated fermentative changes with an increased destruction of carbohydrate and nitrogenous material and an abnormal generation of carbon dioxide.

Whilst one or two of the factors enumerated above might be expected to be in operation in any given case, a combination of all these factors would be a very rare occurrence and would be sufficient to cause an abnormally high evolution of carbon dioxide. In addition the air was very still on Thursday night,

with the result that there was very little movement of air in the upper part of the silo, and no air currents to disturb the air in the well formed by the shrinkage of the material.

Precautions.—If farmers, when filling a silo, would take the following simple precautions, the use of silos should not be attended by danger to human life. The observance of points (3), (4) and (5) would obviate any danger even under such a combination of circumstances as occurred in this case.

(1) The crop should have reached the proper stage of maturity and should not be too dry. With an immature crop the extent and nature of the fermentation that will take place is uncertain; an abnormal volume of carbon dioxide or possibly other dangerous gases may be generated. If the material is very dry it will not tread down closely; the additional air so retained would cause the evolution of a larger volume of carbon dioxide than usual.

(2) The material which has been fed into the silo should be well trodden before work is closed down for the night or for any considerable period during the day. The reason for this is that loosely-packed material will retain more air and, therefore, give off a larger volume of carbon dioxide than material which has been well trodden.

(3) No door should be sealed up unless it is absolutely certain that the material will not sink below the level of the bottom of that door.

(4) Before work is resumed, whether in the early morning or at any time during the day when work has been suspended for any length of time, the lowest door possible should be opened. No one should be allowed to enter the silo until a reasonable time has elapsed after this has been done.

(5) Where the silo is being filled by an elevator, as long an interval as possible should be allowed after the lowest door has been opened to allow any harmful gases to escape. Where a blower is being used to fill the silo, this should be put on for a few minutes before anyone enters the silo, with the object of removing all the stagnant gases. It has been suggested that it would be of assistance in this connexion if the trunk from the blower to the silo were extended downwards inside the silo by removable sections to as near the level of the silage as possible.

The composition of the gases resulting from the fermentation of the silage varies according to the material used. In exceptional circumstances some of these gases might be of an inflammable character. It is, therefore, necessary to add

a warning to farmers not to adopt the common method of ascertaining whether air is foul, namely, that of lowering a lighted candle. Should any inflammable gases be present, an explosion might follow.

A full account of the standard methods practised in this country when making silage is to be found in Miscellaneous Publication No. 53, issued by the Ministry, price, quarter bound, 1s. net, post free.

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CUTHBERT CLARKE

AN 18th CENTURY BOOK-FARMER

G. E. FUSSELL,

Ministry of Agriculture and Fisheries.

LIKE many others of the innumerable writers on agricultural subjects, who may or may not have flourished in the eighteenth century, Cuthbert Clarke remains to us only in his printed word, and in the records of the Royal Society of Arts. From that Society he obtained two awards, one of money and the other a medal, but his book, which was issued in 1777, is perhaps his most important claim to attention. Its full title is:—*The True Theory and Practice of Husbandry deduced from Philosophical Researches and Experience: To which is added, A Compendium of Mechanics.*

Donaldson* gives a very just and concise account of the work. "The dedication of the book on husbandry," he says, "is dated from Durham and addressed to the proprietors and occupiers of land. The intention is avowed to resolve the hitherto varied art of husbandry into a science, and to do so with propriety and clearness. The first section of the theory of agriculture very curiously introduces into it the form of cash accounts in ledger and general receipt books. Then follow the form of receipts, bills and promissory notes and common bills of parcel. The curvilinear shape of ploughed ridges of land are very correctly delineated and the position of the furrow slice is very exact. A general conversation is managed between two speakers, 'Philosophus and Agricola,' who discuss the common topics of farming in an enlightened manner. A form of a lease is given, along with the expenditure and receipts on an arable farm of 300 acres. The second part of the book on mechanics delineates some forms of ploughs; but nothing new, or very worthy of notice. The Rotherham plough is shown with straight handles."

* *Agricultural Biography*, 1854.

Donaldson also states that Clarke was a lecturer in experimental philosophy, and that he published a book on weights and measures, which was of some repute at the time. The title of this book was *A New Complete System of Weights and Measures deduced from an unerring universal unit*, and it was issued at Edinburgh in 1789. Other works of his were *Remarks on the Observations of R. Whitworth upon the plans delivered to . . . . the Lord Provost and Council of Edinburgh, for enlarging and improving Leith Harbour* (Edinburgh, 1787); and *A Philosophicall Investigation into the Origin, Vicissitudes and Power of Steam employed in a Fire Engine; with an explanation of that machine* (Newcastle, 1773).

Clarke's claim to attention, however, rests upon his farming production, and upon the inventions he placed before the Royal Society of Arts. The former he declares to contain his best endeavours to be useful to mankind, and he adds that a competent knowledge of both theory and practice are requisite to enable the harassed farmer (there never has been a time when the adjective was not applicable) to cope with the emergencies he was bound to meet with in the course of his career.

The form of accounts, at which Donaldson has a small gibe, is an intelligent anticipation of a requirement which is steadily becoming more and more emphasized. No one would suggest that it fulfils the demands of modern cost accounting, about which so much has been written for farmers of late, but it is a step in the right direction. Clarke wanted the farmers of his day to keep accounts in order that they might take a more than intuitive view of the success or failure of their various crops. The most emphatic of our agricultural advisory economists demands little more.

Whether he was ever an actual farmer or not, Clarke has a keen perception of the possibility of increasing rent and the margin of yield which would allow the tenant to pay it. He advises care that "the land is not unfairly stripped of its treasure: For if land is reduced to so low an ebb, that the occupiers cannot reap more than fifteen (Winchester) bushels of wheat, and twenty of peas; or fifteen of wheat and twenty-five of oats per acre from a two crop fallow; it is impossible at the present prices of grain (and they are not bad ones) that he can pay either tithe or rent for such land."

As Donaldson says, the book deals with the common matters of every-day farming, so that we find a discussion of the correct size of the furrow slice, the best depth of ploughing, and—what is even more important for the modern reader,

who is unlikely to be anyone not interested in the history of agriculture—occasional remarks upon the common practice of some localities.

Again it is only natural that in discussing the breeds of cattle, sheep and swine Clarke should state where those he specifies were to be found, and, although information of this sort is not explicit, and does not give any idea of the proportion in number of the different types (they were often hardly distinguishable in spite of their varying names), it is on such slender evidence that the historian is forced to rely. The lack of more definite information does prevent us from estimating with an accuracy that cannot be impugned the development of the production and supply of foodstuffs in the eighteenth century: at the same time some quantitative estimate of some of the main items of the common menu may possibly be formulated.

As an experimental philosopher, Clarke had ideas that were not the common possession of his time. He says that he had found that electricity assisted digestion in the animal stomach and the growth of plants in the soil, and he adds in a footnote that experiments carried out by the Abbé Nollet and M. Jallabert confirm his view. I am not equipped to criticise him or to compare what he says with the results of modern scientific experiment, which are, I believe, still indeterminate, although widely discussed. It is significant that "Agricola" admits all "Philosophus" has to say on the subject, but asks "whether that operation . . . . may not yet be compared to placing a pump by the side of a spring of water, in order to fill a reservoir in a less space of time," which it will undoubtedly do. Clarke goes on to say that he has made experiments to test the effect of "electrics" on capillary action in the soil. He used tubes of a very varied selection of materials for this purpose and claims that the "natural electrics," *i.e.*, glass, sealing wax, etc., by simple immersion raise water higher than the non-electrics such as tin, lead, etc. The latter, he implies, when electrified by a machine, do as well as the former.

In the realm of experiment his achievement was his draining plough. For this plough "he had a premium of fifty pounds, October 8, 1766,"* and an improved version was purchased by the Society of Arts on June 1, 1767.†

* Robert Dossie, *Memoirs of Agriculture*, Vol. II, 1771. In Vol. I, 1768, p. 79, the dates are given differently.

† *Op. cit.*, Vol. II.

At this time various draining ploughs were put forward, and the Society also awarded a premium of fifty pounds for one by Mr. William Knowles in 1767, while a Mr. William Makings not only had a bounty of fifty guineas for a plough for making trenches for closed drains, but ten guineas for making a complete plough and carriage. A footnote adds that the last machine would work with four horses, and had earned the "golden" opinion of the Society.

Clarke was a little impatient of his competitors in this field. He gives a plate illustrating the implement amongst others, but the draining plough naturally takes precedence of the more ordinary implements. Of the Society, he says they "were so exceeding cautious in deciding the claim that they appointed a time for the trial of each candidate's machine, made in full size:" six or seven were tried and he got the premium, although he adds in what is no doubt intended to be a completely significant manner "a stranger to all present." As we have seen, however, he was not the only inventor (designer is probably a better word) of a drain plough who was awarded a premium. One of his other plates shows a one-wheel plough of his design for which the Society awarded him a gold medal.

Some fifty years later, Clarke's draining plough is mentioned in terms of no high praise, so perhaps it was not quite so efficient as its inventor believed. Lawson, writing in 1826,* says: "Without noticing all the varieties of ploughs, which have been invented, but not found generally useful, there is one called Clarke's draining plough, which deserves to be mentioned. It is used in Meadow ground, near Belford, in Northumberland" (Clarke lived here at one time), "but cannot be used in stiff clay. Greys' draining plough seems one of the best . . . ." We therefore see that Clarke's plough was used long after his book was read; the plough could only be used with advantage in a particular soil, and the book has sunk into oblivion. Such publications have an ephemeral practical use and are afterwards read, not only for the extraordinary mixture of practical advice and grotesque theory they contain, but because they inform us what was thought and done in an earlier day.

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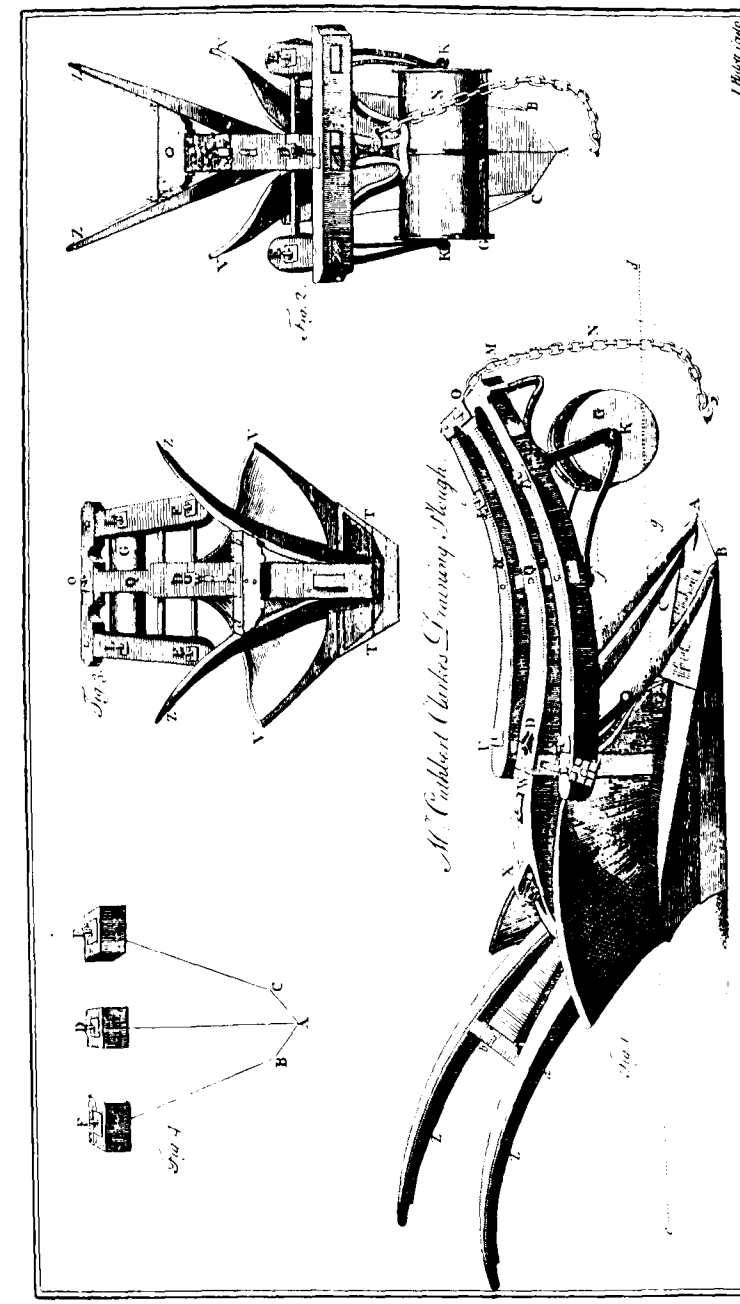
* A. Lawson, *Farmers' Practical Instructor*, 1826, p. 97.



Reproduced from the engraving in "The Complete Farmer" by a "Society of Gentlemen," 4th edition, 1793. The same engraving, however, appears in the 1st edition, 1756.

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NEW FOREST GRASSLAND COMPETITION, 1929

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and
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IN the spring of 1929, the New Forest Agricultural Competitive Association sought the advice of the writers on the organization of a grassland competition, which it was proposed should be carried out during that year, and invited assistance in framing the rules and carrying out the competition. In the opinion of the writers, grassland competitions are a most valuable form of agricultural education work. A competition was, therefore, arranged ; and it was felt that, considering the short time available, and the experimental nature of the system adopted, the entry of 22 competitors was sufficient and satisfactory.

As a preliminary, it seemed desirable to consider the scope of the competition very carefully in the light of the experience gained from similar tests in the past.

Previous Competitions.—Earlier competitions, notably those undertaken in Cumberland and Wales, resulted from an increased demand by farmers for advice on the best method of seeding down land to permanent grass, and of treating such pastures in their early life. The competition was directed first to this end, but a second, and more important, object was the efficient dissemination of the lessons learned in the districts concerned.

In these competitions, the judges visited each competitor, and obtained from him information on the history of the field, seeds mixture used, manuring and treatment ; they then viewed the field and allocated marks on the botanical composition of the sward, evenness of grazing, freedom from weeds and general condition of the pasture.

This pioneer work undoubtedly separated good practice from bad in each district, and the final report of the judges, in which individual competitors were identified only by code numbers, criticized each of the fields entered, and ensured that the experience gained was placed at the disposal of all farmers in the neighbourhood.

The New Forest Area.—The New Forest has long been predominantly a grass area, and contains only a small acreage

of pastures laid down in recent years. Established pastures had, therefore, to be included, and the competition resolved itself into a test of skill in grassland management and not a test of methods of pasture formation.

In judging the efficiency of management, it was obviously necessary not only to have some measure of the production but also of its cost; and, in addition, it was regarded as essential that all competitors should start with an equal chance, irrespective of the fertility of the land. An attempt was also made to ascertain how far each of the factors affecting the maintenance of good grass land was responsible for the result, and what attention was given to each of them when successful management produced a satisfactory financial return.

The objects of previous competitions had not been so comprehensive in their scope, and a question arose whether the methods adopted for them would be suitable for the wider range of the test under consideration. It was finally decided that the adoption of the earlier methods would entail so many drawbacks that it would be preferable to evolve a new technique.

It was thought desirable, in the first place, to keep an open mind on the subject of an ideal turf, and attempt to determine, on a large scale, the type of sward which gives the best result. A second consideration to be kept in mind was the comparative ease with which a competitor could adopt "window dressing" tactics with a single field—possibly a naturally more fertile field than the remainder of the farm —even perhaps to show that special attention and liberal treatment on a limited area pays very well; but results secured in this way may be negatived when applied to a farm as a whole.

Obviously, also, the productivity of grass land, which, when balanced against the cost of production, is the criterion of grassland management, can only with difficulty be measured on a limited area of grazing land by keeping accurate stocking records; whereas the productivity of the grass land on the farm, considered as one unit, can be much more easily estimated.

Chiefly on these grounds it was finally decided that all the permanent grass land on the farm (exclusive of rough grazing) must be examined before any real estimate of the skill of each competitor could be obtained. It follows naturally that, in a competition of skill, as compared with productivity, it

would be necessary to estimate fairly accurately the economic possibilities of each farm under ideal management, adopt this as the standard, and mark competitors on their approach to this standard. Otherwise competitors with naturally poor land would be handicapped from the outset.

In practice few men have the special knowledge requisite in assessing the possibilities of each farm and in analyzing and suggesting remedies for errors in management, and for this reason a trained agriculturist should act as one of the judges in all grassland competitions. Two judges would appear to be desirable, though no hard and fast rule can be made.

It follows, too, that more than one visit to each competitor is required in order to determine that the best use is made of the grass land throughout the grazing season.

The New Forest Competition was undertaken rather late in the year, for under normal conditions a first visit ought to be paid about mid-April, to ascertain if nitrogenous dressings were used for early grass and their effect; a second visit should be made at the flush period about the end of May, and a third in September when the hay in rick should be examined for quality, and if necessary the quantity estimated. In the 1929 competition, however, only the two later visits were possible.

The question of allocating the competitors into several classes received careful consideration. It would appear that an owner-occupier, with greater security of tenure, has more incentive to keep his land in a high state of fertility than a tenant farmer. Further, an owner-occupier may reasonably be penalized for not draining a wet field, for failure to sub-divide areas of grass land which are too large, for neglecting to instal a water-trough in an unwatered grazing field, or for other things involving capital expenditure for which it would be unfair to penalize a tenant farmer. Classes in the competition were therefore provided for owner-occupiers and tenant farmers.

Each class was again sub-divided on a basis of acreage, *i.e.*, above 50 and under 50 acres of permanent grass on the farm. Usually management is simplified on the smaller farm, and a higher level of fertility is more easily reached. This sub-division was also adopted in order to simplify the task of the judges.

The Basis of Judging.—The basis for the award of prizes and

the allocation of points was left to the discretion of the judges, and the following provisional score card was adopted :—

	Marks
Performance (including stocking, length of grazing period, and hay crop)	50
Quality of herbage	20
Freedom from mat	10
Even grazing	10
Drainage and condition of fences	10
	100

The score card was purposely framed with some latitude and in practice it was used only as a guide.

On the first visit, the total acreage of the farm, and the respective acreages of arable, temporary and permanent grass, together with the number of grazing stock carried were noted. It was fortunate that, in the district concerned, stock was practically limited to horses and cattle, so that few calculations involving estimates of the grazing capacity of different classes of stock were necessary. Further, green arable crops were utilized on very few of the farms before the early autumn to supplement the grass—again simplifying calculations of stock-carrying capacity.

The estimated number of stock carried by the permanent grass obtained from these figures was later checked by observing the amount of grass and the condition of the grazing stock, and by reference to the quantity of purchased feeding stuffs fed on the grass.

Each judge had a notebook and made separate observations on each of the fields (which were numbered), including the following items : Acreage ; whether grazed or reserved for hay ; past history including manuring, cropping and cultivations, and, if a new pasture, details of seeds mixtures used ; type of soil (usually a turf was lifted) ; botanical composition of the herbage ; absence of tufts (where grazed) or productivity where mown ; absence of mat and weeds ; condition of fences, ditches and drains ; and particulars of any unusual features. Where two or more fields were grazed together the reason was ascertained.

In addition to the notes made on each field, the judges during their round of inspection with the farmer kept before them the conception of all the grass land on the holding as a unit, considered the size of each field in relation to the farm as a whole, noted the system of manuring and the proportion of grass laid up for hay, and questioned the farmer

on his difficulties and experiences, and on any and every point which appeared to influence his methods of management.

The tour of the farm completed, each judge decided upon the standard which he could reasonably expect the competitor to reach in productivity and quality of pasture, commensurate with satisfactory financial returns if the farm were ideally managed, noted how far he fell below this standard, and allotted him marks out of a possible 100. The judges then compared results, and in only one case, before consultation, did their figures vary by as much as 5 per cent.

On the occasion of the second visit, further general information was obtained regarding each farm, the hay was inspected and the fields visited in the same order as before, and these further observations added to the previous record.

The Final Reports.—The final report of the judges was presented in two portions. The first contained their general observations on the chief features of all the grass land examined, and received adequate publicity through the Society, who also secured its publication in a prominent local newspaper. The second portion consisted of a series of detailed reports on each farm (under a Code letter and a number) including the notes made by the judges on each field and on the farm as a whole, on each visit, with their criticisms and suggestions for improvement. In our estimation, this detailed report is supremely important, and very considerable time and thought was devoted to it.

A few notes of the judges' experiences will perhaps be of interest :—

In the first instance, they attempted to rid their minds of two preconceived ideas, namely :—

(1) That skill in management necessarily entails high output.

(2) That a sward consisting of a well-balanced mixture of "good" grasses and clovers is a *sine qua non* of good management, and is normally essential for high output.

Consequently their allocation of marks to competitors in the first round was provisional only until they had sufficient evidence to justify a decision. They were eventually satisfied (though they necessarily arrived at this conclusion by empirical methods) that skill in management, which involves reasonable hope of a satisfactory financial return, does entail maintenance of output at a high level.

Second, by comparing the type of herbage in the pastures with stock-carrying capacity, they were finally satisfied that in

the particular district concerned, a balanced grass and clover herbage is the basis of high output with moderate costs, since, not only is the stock-carrying capacity high, but maintenance is easier because of the more even grazing, less expensive cultivations required, and greater water retention in drought. A certain latitude, however, is permissible in the case of fields regularly mown for hay.

They were surprised that the average difference between competitors in the owner-occupier and tenant farmer classes was so small as to be negligible. Broadly, they noted that the owner-occupiers spent more on fertilizers, but devoted less time to cultivations than the tenant farmers, who, with more modest fertilizer bills, secured comparable and perhaps even better results by paying considerable attention to regular harrowing, rolling and close rotational grazing. An excellent example of this peculiar feature was provided by the champion prize winner, a tenant farmer, whose pastures, on naturally poor soil, stood out in marked contrast to the surrounding land, and whose methods of management were extremely sound, yet very economical both in cash outlay and in total cost.

One drawback became apparent in the cases of two competitors who had recently entered their holdings. By the method adopted, farms were judged as they were found, as compared with their estimated condition under ideal management, and consequently the present occupiers received the benefits or disadvantages of the legacies handed down by previous tenants. To attempt to make allowances for these legacies would, in the writers' opinion, render the task of judges who know nothing of the previous condition of the farms much more difficult, and admit a more serious risk of error.

The notes on the practical details of grassland management in the district show that from the first the judges were struck by the outstanding uniform success of the Cockle Park type of seeds mixture in pastures laid down during recent years. Rotational grazing certainly resulted in better pastures, and a higher stock-carrying capacity.

Hay crops on the whole were heavy in spite of the drought, and they were satisfied that mowing the same fields each year, when combined with adequate manuring and heavy grazing of the aftermath, resulted in heavier crops, and the increase in crop usually followed on what, at first sight, might be regarded as deterioration in the botanical composition of the herbage.

The advantages of using artificial fertilizers were well understood by all the competitors, but the advantages of adopting some system in their application were less generally grasped. Odd cases of injudicious and extravagant dressings came to our notice. On the other hand, the necessity for cultural treatment and control of grazing was not appreciated as it ought to be.

The acreage dressed with nitrogenous fertilizers surprised the judges, and though the first visit was paid too late to gauge results in early grazing, applications on the hay crop were yielding very satisfactory results.

Lime gave excellent results on young pastures, but the returns on established turf were not nearly so certain.

It was also frequently brought to notice that the first stage in the improvement of a poor pasture, namely, securing an increase in the clover population, is a fairly easy and speedy process, but that the second stage of improvement, replacement of the useless by the better species of grasses, requires a much longer time and is less certain.

It is pleasing to record the educational success of the competition, as evidenced by the keenness of the competitors, their appreciation of the constructive criticism contained in the detailed reports on their farms, and their enthusiasm for a similar competition in the current season.

It may be mentioned also that a large number of inquiries regarding the competition have since been received from other districts in this country, both by the writers and by the Secretary of the Society, and although a great deal of time must be devoted to organization and judging, the results are worth the time and trouble expended.

Only a limited number of competitors can be dealt with each year (though the actual number will depend on the average size of the farms in the district concerned), and it would appear to be necessary, in framing the conditions of such competitions, that a farm entered in one competition shall not again be eligible for entry except after some interval of time, thus allowing the competitor time to act upon the advice given.

Further, though three visits may be considered the ideal, two visits should be sufficient to arrange the competitors in order of merit, and a third visit may only be really necessary in a limited number of cases where few marks separate competitors who have a chance of winning a prize.

The writers are agreed that they have not yet sufficient reason for suggesting any radical alterations in the methods or technique of adjudication, experimental and empirical though they may be, and they are not at all satisfied that an accurate stocking record, or even the less practical costing of the grass land, would solve the major difficulties.

Conclusion.—In conclusion, the writers have carefully considered also the extension of this work by initiating a Grassland Improvement Competition, and have rejected the idea for the present on two grounds. Firstly, the County Organizer must be available to all the farmers in the county for advice, and naturally many competitors would obtain his assistance in an advisory capacity. The effect of such a competition might be primarily regarded as a test of the skill of the County Organizer in diagnosing the troubles on the various farms, and in selecting the correct treatment—and only to a very small extent a test of the skill of the farmer.

Secondly, not all grass land reacts to efficient treatment at the same rate, and it appears at present impossible to differentiate with any precision between a naturally slow reaction and slow improvement consequent upon inefficient methods.

It has therefore been decided that the 1930 Competitions in this county will follow the lines of that of 1929. A limited area only will be covered in any one competition in order to eliminate, as far as possible, the difficulties which might arise through securing entries of widely different types of farms.

Grassland competitions appear to offer an excellent opportunity for co-operation with local agricultural societies, and their educational value may be regarded as important as that of the show, or the ploughing or other manual process competition. They offer a far greater opportunity than other types of crop competition as usually carried out, if only because of the large acreage of grass and the need for general improvement in its management.

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EFFECT OF CONSOLIDATION UPON THE BOTANICAL COMPOSITION OF POOR GRASS LAND

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THE term consolidation is here used to denote any mechanical compression or treading of the surface of grass land by animal or human agency. The popular term for this process is "hoof cultivation."

The outstanding contrast between the herbage of the footpath or gateway region and the remainder of a pasture is too well known to need description. It is generally understood that the difference is due to consolidation.

The radical changes induced by consolidation are ascribed to various factors, and the writer has attempted to investigate the exact part played by each factor. The theories arising from the observations have been tested experimentally.

Botanical analyses of the consolidated and of the adjoining unconsolidated portions were made during the winter of 1929–30, and under widely differing conditions. The first three analyses set out below were made in North Lancashire, and the remainder in North-East Derbyshire. A large number of cursory observations in other localities have confirmed the first findings.

In the following examples the percentages express the proportion of ground covered by the different species. In the case of footpaths, areas which were trodden bare were not included, and in each case marginal regions were neglected, but are discussed later. The Broad-leaved Plantain (*Plantago major*) was often present to the extent of 30 per cent. of the ground covered, but, as the plants were dead or dormant in winter, they were neglected.

The areas numbered below are as follows :—

Area	*Place*	*Formation*
1. Sheep Walk	Tarn Hows	Silurian Limestone
2. Larch Wood	Gooseyfoot Tarn	Silurian Slate
3. Ungrazed Paddock	Hawkshead Hill	Boulder Clay
4. Pasture	Whitwell	Magnesian Limestone
5. Pasture	Ashgate	Coal Measures
6. Ungrazed Paddock	Ashgate	Coal Measures
7. Pasture	Hardwick	Magnesian Marl
8. Mixed Wood	Walton	Coal Measures

The consolidated portions represent footpaths, except in examples 4, 5 and 7, where gateway regions were taken.

	UNCONSOLIDATED AREA								CONSOLIDATED AREA							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
			Percentages						Percentages							
Bent (*Agrostis spp.*)	30	—	45	30	23	34	37	48	—	—	28	43	10	23	20	15
Sheeps Fescue (*Festuca ovina*) ..	18	—	15	42	10	33	33	—	—	—	55	14	43	57	22	63
Woolly Softgrass (*Holcus mollis*) ..	—	—	13	—	27	26	—	37	—	—	11	27	47	15	58	22
Tufted Hairgrass (*Aira caespitosa*) ..	—	—	—	—	—	—	22	10	—	—	—	5	—	—	—	—
Wavy Hairgrass (*Deschampsia flexuosa*)	—	70	—	—	—	—	—	—	—	100	6	—	—	5	—	—
Heath Bedstraw (*Galium saxatile*) ..	—	25	—	—	18	—	—	—	8	—	—	—	—	—	—	—
Sweet Vernal Grass (*Anthoxanthum odoratum*)	—	—	—	—	—	—	—	—	14	—	—	—	—	—	—	—
Molinia (*Molinia coerulea*)	12	—	—	—	—	—	—	—	65	—	—	—	—	—	—	—
Moor Mat Grass (*Nardus stricta*) ..	5	—	—	—	—	—	—	—	13	—	—	—	—	—	—	—
Quaking Grass (*Briza media*)	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Bilberry (*Vaccinium myrtillus*)	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tall Fescue (*Festuca elatior*)	—	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—
Wild White Clover (*Trifolium repens*)	—	—	—	10	17	—	—	—	—	—	—	—	—	—	—	—
Smooth-stalked Meadow-grass (*Poa pratensis*)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Perennial Rye-grass (*Lolium perenne*) ..	—	—	—	8	—	—	8	—	—	—	—	—	—	—	—	—
Crested Dogstail (*Cynosurus cristatus*) ..	—	—	15	5	—	7	—	—	—	—	6	5	—	5	—	—
Cocksfoot (*Dactylis glomerata*) ..	5	5	7	5	5	—	—	5	—	—	—	—	—	—	—	—
Miscellaneous	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

It was not considered necessary to carry out the analyses in great detail, as the object was to illustrate a fact which may be confirmed by observation.

The figures, in the case of the consolidated portions, exhibit a remarkable similarity. The following species are dominant or sub-dominant, in every case, and practically exclude all other species : *Poa pratensis*, *Lolium perenne*, *Trifolium repens*, *Dactylis glomerata* and *Cynosurus cristatus*.

An examination of any flagged footpath or sidewalk, where grass grows between the flags and is well trodden, reveals the fact that *Poa pratensis* is not only dominant, but other species are present in such small amount as to be negligible. The runners enable this plant to penetrate the interstices, but other plants possessing runners are killed off.

FLAGGED FOOTPATHS AND SIDEWALKS
(Average of 20 Cases)

Margin of Path	per cent.	*Interstices of Flags*	per cent.
Bent (*Agrostis spp.*) ..	35	Smooth-stalked Meadow-grass (*Poa pratensis*) ..	95
Woolly Softgrass (*Holcus mollis*)	15	Miscellaneous	5
Sheeps Fescue (*Festuca ovina*)	25		
Couch or Twitch (*Agropyrum repens*)	5		
Wild White Clover (*Trifolium repens*)	5		
Smooth-stalked Meadow-grass (*Poa pratensis*) ..	5		
Annual Meadow-grass (*Poa annua*) ..	5		
Miscellaneous	5		
	100		100

An experiment, aiming at a close imitation of the action of the hoof during wet weather, was carried out by Capt. J. D. Penrose in Hardwick Park. An analysis of the resulting herbage and a comparison with the untreated portion gave results similar to the above examples.*

Out of 58 footpaths examined, it was found that in two cases the rule did not hold good, the herbage consisting of a mass of fine-leaved fescue, mainly in a dead condition. An investigation into the cause showed that the underlying earth was excessively dry. One path traversed the site of old ironstone workings and the other was on a raised road, built on ashes.

Even on these dry roads, small patches of *Poa pratensis* and *Lolium perenne* were observed, though they were in small hollows where moisture had collected and puddling had taken place.

* This JOURNAL, Vol. xxxvi, No. 4, p. 323.

It appears that treading alone is not responsible for the change, but that soil must be brought to the surface. In this connexion it has been observed that attempts at mechanical improvement of grass land on dry hillsides have been doomed to failure, whereas close treading with sheep in wet weather has effected the desired result.

Discussion of Factors.—The factors responsible for the changes brought about by consolidation may, at first sight, appear complex, but an examination of each one in turn points to one factor as primary and others as secondary. As the importance of mechanical improvement and cultivation of grass land along the lines of " hoof cultivation " is becoming realized, it was thought that an attempt to understand the exact way in which the change is brought about might be of economic as well as scientific value.

The factors are considered in the following order by a process of elimination :—

Plant Food.—The fact that the consolidated parts of a pasture are closely grazed means that they receive an extra supply of droppings and urine and this will, in some degree, show a result. In examples 3, 6 and 8, however, there was no grazing by stock, and in examples 3 and 6 even rabbits were excluded.

The deep green coloration of the consolidated areas may be explained by the deep green colour of the dominant species (with the exception of *Dactylis glomerata*), and to the fact that *Poa pratensis* and *Lolium perenne* are winter-green grasses.

Water Supply.—On a matted pasture, the footpath and gateway region will offer a much readier access to water than on parts where the herbage is matted. The fact that many of the dominant species on the consolidated area are deep rooted augments the water theory, but on the other hand *Poa pratensis* is very shallow rooted. In the case of example 4, the turf was all of a very open nature and covered with worm casts. In the case of flagged footpaths, the soil is always moist beneath the flags.

While there is no doubt that the free passage of water, forming a reserve in the soil, is beneficial to many pasture plants (as evidenced by the practice of turf slitting on matted pastures), it does not appear to be the dominant factor in this case.

Light.—There is no doubt that light is a potent factor in the case of *Trifolium repens*, but both *Dactylis glomerata* and *Lolium perenne* can compete for light. In example 2, where the turf was shadowed by trees, *Trifolium repens* was absent.

Bruising of foliage will allow the access of light, as will the inhibition of the tall habit, but an example of suppression of foliage without consolidation may be seen on lawns or putting greens. The dominant species are those which can escape severe cutting.

The following analysis of a cricket pitch and the surrounding herbage will illustrate this point. The example is typical of most lawns of long standing, whether they have been manured or not :—

CRICKET PITCH AND SURROUNDS : HARDWICK PARK

Unmown portion	per cent.	*Mown portion*	per cent.
Bent (*Agrostis spp.*)	47	Woolly Softgrass (*Holcus mollis*)	32
Sheep's Fescue (*Festuca ovina*)	22	Wild White Clover (*Trifolium repens*)	12
Tufted Hairgrass (*Aira caespitosa*)	6	Heath Bedstraw (*Galium saxatile*)	20
Cocksfoot (*Dactylis glomerata*)	20	Mouse - eared Chickweed (*Cerastium spp.*)	10
Miscellaneous	5	Daisy (*Bellis perennis*)	13
		Plantain (*Plantago spp.*)	8
		Miscellaneous	5
	100		100

It is observed that the herbage of closely mown grass land differs considerably from that of consolidated ground. While light is of vital importance in the case of *Trifolium repens*, it can be relegated to a secondary position as far as the other species are concerned.

Consolidation of the Soil.—It was thought that the consolidated condition of the soil might play some part, as the condition might be favourable to the development of some species and not to others. An experiment was carried out by the writer, to test this theory, in the following manner :—The chief species concerned were grown in flower pots, both separately and in association. One set was grown in consolidated soil, the other in loose soil. The soil was from the same source in both cases. The experiment was repeated in a garden border, part of each plot being consolidated to varying degrees, and the remainder left loose. All the plants were undisturbed during their growth.

In all cases the plants from the consolidated soil were about half the size and weight of those from the loose soil, and it was notable that the root development was very poor in the former case.

It is a popular idea that the dominance of clover on a headland in a field of "seeds" is due to consolidation. In the opinion of the writer this is a fallacy, the factor at work in this case being light. The headland is at the edge of the field where, though the crop may be shaded to some extent by the hedge, light nevertheless penetrates because the sown crop is thin. The same phenomenon may be observed in other parts of the field where the nurse crop is thin.

The evidence showed very clearly that consolidated soils are not in themselves beneficial to any species.

Resistance to Injury.—The final factor to be considered is that the peculiar structure of the dominant species on the consolidated parts enables them to resist injury by treading. It is a striking fact that all these dominant graminous species have a folded leaf section, in contrast to the rolled leaf of the other species. The leaves and their sheaths are consequently flat and offer a flat surface to the crushing action of treading. They are also able to assume the rosette habit of growth.

Another notable feature is that the basal nodes, which give rise to the growing parts of the leaf and stem, are situated well below the surface of the earth, and this in marked contrast to the species most injured by treading. A longitudinal section, cut with a sharp knife, will reveal this fact very strikingly in the case of *Lolium perenne*, a grass which on first sight appears to be well above the ground.

In most of these species, the rootstock is woody, and in the case of *Dactylis glomerata* and *Plantago media*, an experiment showed that the treading actually stimulated the growth of woody tissue. The fact may be demonstrated by cutting a longitudinal section through a plantain grown on a well trodden footpath and contrasting it with one from a loose soil.

A further experiment was carried out by the writer to test the theory of resistance to injury. The following grasses were grown in separate and repeated strips:—*Poa pratensis*, *Dactylis glomerata*, *Lolium perenne*, *Anthoxanthum odoratum*, *Alopecurus pratensis* and *Agrostis vulgaris*. The ground was then utilized as a garden path and trodden daily. *Poa pratensis* assumed a low dense habit, *Dactylis* and *Lolium* were suppressed in growth, but persisted. The three remaining species were exterminated by the treading.

The resistance of the various species to degrees of consolidation may be seen in any gateway to a pasture. There is a bare patch between the gateposts where the treading is too severe for any plant. This is followed by a zone of *Plantago* *spp.* and possibly Knotgrass (*Polygonum aviculare*). Beyond this is an association of *Poa spp.* and *Lolium perenne*, followed again by *Trifolium repens*. Further out in the field the herbage may be benty and matted.

Characters of Certain of the Plants.—As *Poa pratensis* is the dominant grass in most cases, a discussion of its characters may be of interest. The structure of the leaves is worthy of consideration. They are short and strong, and at the same time concave in cross and longitudinal sections. Observation after treading upon the growing plant gives the impression that the leaves are specially adapted to allow them to spring back into place, the ability to do so being more marked than in any other species. Profuse seeding may account for the readiness with which the plant appears, but this is not more marked than in the case of *Poa annua*. The runners may help to penetrate into unpopulated regions, but other stoloniferous plants, equally well equipped, do not persist on consolidated soils.

Poa annua is not able to resist treading owing to its delicate foliage. Its presence may be explained by its extremely transient nature which enables it to occupy the ground between the periods of consolidation. This plant may also dominate small hollows or spaces between cobblestones where it escapes treading.

Poa trivialis was never observed in any quantity in any of the examples. The reason for this cannot be accounted for by the writer.

Trifolium repens is able to withstand consolidation in virtue of its tough creeping stem and woody rootstock, but it is not resistant to defoliation and may be found almost denuded of leaves.

Summary. — It seems apparent that the primary factor inducing the changes in the herbage, brought about by consolidation, is the eradication by injury of the species not structurally adapted to resist treading or crushing by implements, and the advent of species which are so adapted.

It is further evident that consolidation restricts the development, even of the species adapted to it, and, if carried to an extreme, will result in their extermination. The zonation of herbage around a gateway indicates that species exhibit varying degrees of resistance. If the operation is adapted to agricultural practice, either by mechanical means or by close treading by stock, the limits of severity must be studied.

In experimental work, close mowing is not a true imitation of close grazing, as in the former case there is no consolidation by the hoof. This is instanced by the example of the herbage of established lawns, whether they have been manured or not.

MARKETING NOTES

National Mark Egg Scheme.—During the five months March–July, 1930, the total output of eggs from the authorized packing stations was 111 millions, of which 79 millions were packed under National Mark labels. Production is now decreasing, however, with the result that prices have been very firm during the past few weeks. A considerable proportion of the eggs received at packing stations at this time of the year are of inferior quality and unfit for packing under the National Mark. Where the producer is paid for supplies on "grading out" results at the packing station, no loss is incurred by the packing station or by other producers supplying the station if any individual producer offers inferior eggs for grading and packing, but in the case of packing stations who buy on a flat rate, the lower value of inferior supplies becomes a charge on all producers supplying the station, with the result that producers of first-quality supplies are at some disadvantage. The only sound method of paying the producer is on the basis of "grading out" results.

Poorness of quality at this season may be caused by holding for a rise in prices; it may also be due to a variety of other causes, including exposure of supplies to heat and strong light, and the debilitated condition of laying stock, which is often the result of faulty management.

The National Mark Egg and Poultry Trade Committee at their meeting on August 13, 1930, following a discussion on the present position and future developments of the National Mark Egg Scheme, unanimously passed the following resolution :—

> "The National Mark Egg and Poultry Trade Committee feel that the time has arrived when they should submit their opinion on the marketing of eggs under the National Mark to the Minister of Agriculture and, through him, to the Government. When the marking of all imported eggs came into force it was acknowledged by every producer that unless some steps were taken to raise the general standard of the British supplies, and by doing this to inspire confidence among buyers by eliminating the inconvenience and risk attaching to the purchase of ungraded supplies, the marking of imported eggs might tell against instead of in favour of British eggs. To meet this difficulty the National Mark was instituted and packing stations were licensed to use the Mark. Some 150 packing stations are licensed by the National Mark Committee.
>
> The Committee, through experience gained in dealing with the packing stations, have arrived at the following conclusions :—
>
> (1) The National Mark has raised the standard and quality of the British egg.
> (2) The National Mark has raised the general price of British eggs to the producer.
> (3) It has given confidence to large-scale buyers who need a standardized and reliable product in substantial quantities.
> (4) It has taken the British egg into large consuming centres where very few, if any, home produced eggs were previously sold.
> (5) With the publicity secured for the scheme and the higher standard of British eggs it has increased the demand and price for home-produced eggs.
>
> Notwithstanding these favourable results, the Committee feel that unless some drastic steps are taken to guard the good work already done the movement may not continue to go forward in the manner desired.
>
> The Committee, therefore, feel that some action should be taken to counteract the difficulties which are besetting the National Mark scheme so far as eggs are concerned.
>
> The principal difficulties are set out in the paper which was read by the Head of the Markets Division of the Ministry at the World's Poultry Congress.
>
> Having surveyed the position from all its aspect the Committee consider that it would be useful if consideration were given by the Minister and by the various organizations concerned to the possibility of legislation which will make the reform of egg marketing a permanent and accomplished fact."

National Mark Beef.—The number of sides (including quarters and pieces in terms of sides) of beef graded and marked with the National Mark for the four weeks ended August 16, 1930, was as follows :—

Week ended	*Select*	*Prime*	*Good*	*Total*
	LONDON			
July 26	555	643	22	1,220
August 2	482	640	42	1,164
" 9	600	833	36	1,469
" 16	496	944	32	1,472
	BIRKENHEAD*			
July 26	128	338	1	467
August 2	54	376	—	430
" 9	38	406	—	444
" 16	57	377	—	434

* Sides consigned to London.

Week ended	Select	Prime	Good	Total
	SCOTLAND*			
July 26	2,112	436	—	2,548
August 2	1,928	421	—	2,349
" 9	1,776	498	—	2,274
" 16	1,924	466	—	2,390
	TOTAL LONDON SUPPLIES (*All Sources*)			
July 26	2,795	1,417	23	4,235
August 2	2,464	1,437	42	3,943
" 9	2,414	1,737	36	4,187
" 16	2,477	1,787	32	4,296
	BIRMINGHAM			
July 26	18	111	25	154
August 2	30	104	22	156
" 9	31	95	6	132
" 16	36	114	7	157

* Sides consigned to London.

August is always a quiet month in Smithfield Market, owing to the holiday season. Nevertheless, sales of National Mark beef have remained satisfactory, but there was some decline in price during the month. An increased quantity of Birkenhead-killed beef was on the market, not all of which was marked. The indications are, however, that a higher percentage of this beef will be marked in the coming month, since so many retailers are asking for National Mark beef.

Some improvement has taken place in the Birmingham situation.

Preference for the "Select" grade continues. Supplies reaching this grade are readily absorbed, indicating that farmers who aim at supplying the Smithfield Market should concentrate on the type of cattle which can be brought up to the "Select" standard. It is still the case that graders are obliged to put into the "Prime" grade many cattle of inferior conformation which in other respects might have been graded "Select." In view of the difference in price between the two grades, the importance of correct breeding cannot be over-emphasized.

It is of interest to note that the United States Department of Agriculture has announced that the Government beef grading and marking facilities, which are at present available at Boston, Chicago, Topeka, Kansas City, New York, Omaha, Philadelphia and Washington, were, in July, 1930, extended to Buffalo, Cleveland, Detroit, Erie and St. Louis. As in Great Britain, the service is carried out by experienced beef graders and a similar roller stamp is employed. Beef carcasses

and pieces in the United States are marked according to quality in the following grades: U.S. Prime, U.S. Choice, U.S. Good, and U.S. Medium. A small charge is paid by the trade for the grading and marking service.

The United States scheme was started in May, 1927. During the first five months of 1930 there was an increase of 62 per cent. in the quantity of beef graded and marked compared with the corresponding period in 1929. The Department states that it receives an increasing number of requests for grading and marking from slaughterers, wholesalers, retailers and hotels and restaurants.

National Mark Apples and Pears.—With the arrival of the apple and pear season, many inquiries have been received, and additional growers have been enrolled in the National Mark Scheme. Amendments to this Scheme, which have been made in the light of experience of the first two years of working, necessitated the revision of Marketing Leaflet No. 7; copies of this, as revised, may now be had on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1. The principal alteration is in relation to dessert apples, of which only "Extra Fancy" and "Fancy" may now be packed under the Mark, "C" grade being excluded.

National Mark Strawberries.—The season which has now closed was remarkable in that the early and main crop varieties of strawberries came on to the market almost simultaneously and caused something approaching a glut. National Mark fruit, however, was in excellent demand and commanded good prices. Although this was the first season of the Scheme, a gratifying measure of success was attained, and general satisfaction has been expressed.

National Mark Cherries.—Growers who were authorized to apply the National Mark to cherries have had a similar experience to the strawberry packers, in that although fruit was very plentiful, National Mark packs commanded good prices and sold well. The Ministry is confident that the Scheme will lead to a steady increase in the grading of this fruit. The attention of growers has been drawn to the desirability of the use of small non-returnable packages in order to meet modern retail requirements.

National Mark Canned Fruit, Peas and Beans.—The Minister has appointed Mr. W. P. Seabrook to be an additional member of the National Mark Canned Fruit Trade Committee, as a representative of fruit growers.

The following London firms have been added to the list of authorized canners :—

Army & Navy Co-operative Society, Ltd., 105 Victoria Street, S.W. 1.

Crosse & Blackwell, Ltd., Soho Square, W.1.

It is now certain that the National Mark will be applied to many millions of cans of home-grown fruits, peas and beans during the present season.

National Mark Wheat Flour.—It is just a year since the first "Marketing Note" on the wheat-flour scheme appeared in these pages. No estimate can be given of the total quantity of National Mark flour milled and sold since that date, but it is known that the output during the first six months of the present year exceeded 100,000 cwt. This amount is, of course, only a fraction of the national consumption of flour during the same period, and even of the total flour milled from English wheat. What is of greater significance is that the bulk of the National Mark flour has been milled by a comparatively small number of millers, who are able to judge from the steadiness of the demand that their customers find the product satisfactory.

The maintenance of the quality standard is of supreme importance to the Scheme, and the technical skill of the "authorized millers" provided the Wheat Flour Trade Committee, from the outset, with a *fair average quality standard* of National Mark flour which has enabled the product to hold its own in comparison with the finest flours of other grades. This standard has been rigorously maintained by the Trade Committee, and National Mark flour, therefore, is not open to any criticism on the ground of quality ; in fact, some millers have thought that the standard is too high.

Suggestions for amending certain details of the scheme have been made and have received careful consideration by the Trade Committee and the Ministry ; but the preponderance of evidence has shown that the scheme, with its ban on bleaching, chemical treatment and extraction of patents, and its insistence on the use of sound well-cleaned wheat, has provided a solid basis for a workable system of standardization of flour produced from home-grown wheat.

National Mark Malt Products.—The following firm has been enrolled in the scheme as authorized makers, and has joined the National Mark Malt Products Association :—

Shardlow Malt Extract Co., Ltd., Shardlow, Derby.

Publicity for National Mark Produce.—One National Mark Week was held during the month of August, viz., that at Barnstaple, at the time of the Millenary Celebrations held in that town, August 8–16. Arrangements are well forward for the holding of further National Mark Weeks in the late summer and early autumn at Hereford (Sept. 5–11), Bedford (Sept. 22–27), Bradford (Sept. 24–Oct. 4), Watford (Sept. 29–Oct. 4), Southampton (Oct. 4–11), Llanelly (Oct. 7–16), and Cambridge (Oct. 27–Nov. 1).

Plans for advertising National Mark produce on a wider basis during the autumn and early winter have been formulated. Experience in connexion with National Mark Weeks already held indicates that there is a strong preference among consumers for home produce, provided that it can be readily recognized as such and that its quality is good ; the time is therefore ripe for the National Mark—what it is and what it represents—to be brought more prominently before the public. Arrangements to this end are in hand, and, at the same time, publicity is in contemplation designed to bring home to producers and distributors the part they can play in the production and distribution of increasing quantities of well-graded and well-packed home produce of guaranteed quality under the National Mark.

Following the experiment of advertising National Mark beef, tomatoes and cucumbers, and eggs on London omnibuses for four weeks in midsummer, it has been decided to advertise National Mark beef, canned fruit, canned peas, and malt extract with cod-liver oil in a similar manner for a period of 15 weeks commencing in mid-September.

National Mark Booklet.—The Ministry has recently issued a second edition of the National Mark booklet, which contains a brief outline of the objects and scope of the National Mark scheme for the better standardization and marketing of home agricultural and horticultural produce, together with a statement of its advantages to producer, distributor and consumer. The booklet also gives a short description of the scheme in its special application to the following home-produced commodities which, according to season, are now sold under the National Mark : apples, pears, tomatoes, cucumbers, strawberries, cherries, canned fruits, canned peas and beans, eggs, dressed poultry, all-English wheat flour, malt products, and beef (the last in London and Birmingham only). Copies of the booklet may be obtained, free of charge, on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

Marketing Demonstrations.—Two demonstrations are to be given by the Ministry during September, namely :—

Bucks County Show	at Waddesdon Hall.	Sept. 4	National Mark
Frome District Agricultural Show.	at Fromefield, Frome.	Sept. 24	Cheese.

The cheese-marketing demonstration, shown for the first time at the Royal Show, Manchester, illustrated the lines on which the National Mark might be applied to cheese.

An exhibit of four cheeses of varying fat-content suggested that a guarantee might be given by the producer that whole milk only had been used in the manufacture of cheese intended to bear the National Mark. This guarantee could be applied by means of casein plaques or discs bearing (*a*) the words "Guaranteed made from whole milk"; (*b*) a serial number identifying the maker; and (*c*) a code signifying the date of manufacture (see Fig. 1). The ultimate test to ascertain whether whole milk had been used would be the analysis of the cheese, it being assumed that a minimum fat percentage of 45 per cent. in the moisture-free substance indicates the use of whole milk. A chart of the results of 65,000 analyses made in Holland of whole-milk cheese showed that the percentage risk of failure to secure this proportion of fat was only 0.5 per cent. Up to this point, the exhibit was described as Stage 1.

Stage 2 dealt with the application of the National Mark to cover the other quality features of cheese, namely, flavour, texture and body, colour and appearance. An exhibit of several cheeses which had developed defects of quality in one or other of these respects since purchase from the producer emphasized the importance of delaying the application of the National Mark to within a few days of the cheese being dispatched to the retailer. By so doing, the risk of deterioration after marking would be reduced to a minimum.

Two grades of cheese were suggested, namely, "Selected" and "Selected Mature"; in both cases the cheese would be required to conform to quality standards laid down for the appropriate grade, and, in the latter case, might be required to have reached an age of three months since manufacture; moreover, the National Mark and grade would be applied only to cheese which bore the producer's plaque guaranteeing the use of whole milk in manufacture.

A possible method of application by means of a blow-lamp branding instrument was demonstrated (see Figs. 2 & 3); this instrument makes a mark on the outer bandage and a suffi-

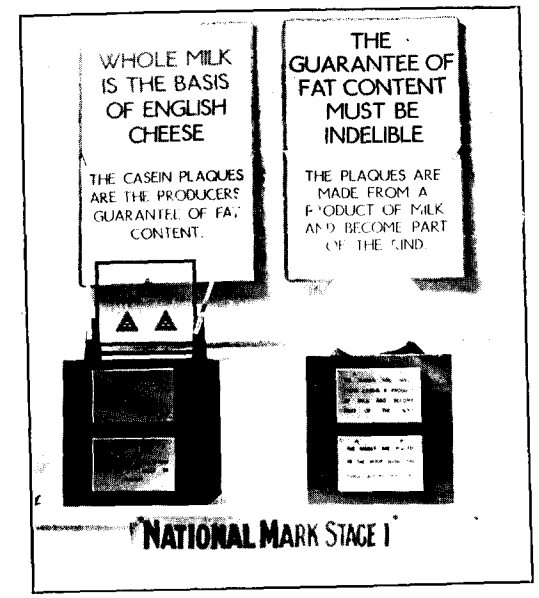

FIG. 1. Casein plaques or discs to certify manufacture from whole milk.

FIG. 2. Application of the National Mark by blow-lamp branding instrument.

FIG. 3. Showing mark made by means of blow-lamp branding instrument.

METHODS OF APPLYING THE NATIONAL MARK TO CHEESE.

ciently deep indentation in the rind for it to appear when the bandage is removed. The brand demonstrated consisted of the National Mark, the registered number of the authorized user of the branding instrument, and letters signifying the grade.

The demonstration also included an exhibit of home-produced and imported cheese showing the various methods that are now adopted for grading and trade-marking cheeses of different varieties and types.

A feature of interest was a cheese-judging stand, where the public were invited to sample and express their opinion on the relative merits of three Cheshire and three Cheddar cheeses of different qualities. In the course of time some interesting records should be obtained in this way.

The whole exhibit aroused much interest among producers and distributors, the proposals for applying the National Mark being much discussed and meeting with general approval.

Economic Series.—The demand for this series of marketing reports is still keen, 1,069 copies having been sold, so far, at the Ministry's marketing demonstrations this year. A full list of the Series can be had on application to the Ministry.

Marketing Grants.—From funds made available by the Empire Marketing Board for the improvement of marketing of agricultural produce, the Ministry, from time to time, makes certain grants to educational and other bodies in order to assist marketing investigations and experiments.

The following grants were made during 1929 and the first six months of 1930. Those marked with an asterisk are in continuation of grants previously made (see p. 1190 of this JOURNAL for March, 1929).

Amount (Not exceeding)	*To whom paid*	*Purpose*
1929		
£42 for one year	Wiltshire Egg Producers, Ltd.	To provide costings data in respect of egg packing station.
,, ,, ,,	Norfolk Egg Producers, Ltd.	,, ,, ,,
,, ,, ,,	Cumberland Poultry Farmers, Ltd.	,, ,, ,,
,, ,, ,,	Melton Mowbray and District Farmers' Assn.	,, ,, ,,
*£688 (Academic year July, 1929—June, 1930.)	Agricultural Economics Research Inst., Oxford	For extension of the study of marketing farm products.
*£175	Pershore Co-operative Fruit Market.	Third and fourth years of a grading experiment.

Amount (Not exceeding)	*To whom paid*	*Purpose*
1929		
*£800 (Academic year October, 1929—September, 1930.)	Cambridge University.	Pig-recording scheme in conjunction with St. Edmundsbury Bacon Factory.
*£194 7s. 4d. 4s. per ton offered for 1930 season.	Norfolk Fruit Growers, Ltd.	To meet cost of inspection of graded black currants marketed under an experimental scheme.
*£300	Gloucestershire Marketing Society, Ltd.	To meet additional costs incurred while acting as a demonstration egg packing station.
*£552 (Academic year October, 1929—September, 1930.)	University College of Wales.	Marketing investigations.
*£125 (additional)	University College of Wales.	Statistical investigations relating to marketing.
*£218 2s. 0d.	National Institute of Agricultural Botany, Cambridge.	Expenses in connexion with the testing of seeds for export.
£250	Clynderwen and District Farmers' Association.	To meet additional costs incurred while acting as a demonstration centre for egg-packing.
£75	Devon Butter Producers' Association.	To assist a scheme for the better marketing of Devonshire butter.
1930		
£125	Midland Agricultural College, Sutton Bonington.	Investigation into the distribution and consumption of meat and fresh-meat products in the town of Loughborough.
£15	Somerset Beekeepers' Association.	Towards expenses of grading experiment.
£800	National Mark Egg Central, Ltd.	To assist establishment of a central federation of egg packing-stations.
£100	Littleton and Badsey Growers, Ltd.	Towards certain additional costs incurred in connexion with an asparagus grading pool.
£85	University College of N. Wales, Bangor.	Investigation into the marketing of washed and unwashed Welsh wool.

Cheaper Maize for Poultry Feeding in Germany.—The Maize Department of the Reich has now commenced the maize campaign, decided upon in May and recently approved by the

Reichsrat, by which poultry keepers who comply with the regulations for the delivery of fresh eggs to the recognized co-operative societies or collecting stations will receive coupons entitling them to draw supplies of monopoly maize at favourable prices. Recognized poultry breeders will also have similar facilities for obtaining cheap maize. For every 100 eggs delivered or for each hen bred in the year, the farmer concerned will receive 15 kg. maize. The campaign is expected to assist the general tendency towards standardization in the poultry industry, as farmers who do not comply with the regulations of the egg-marketing scheme will not have an opportunity of drawing supplies of cheap maize.

Poultry Shaping and Cooling Plant.—A system of shaping and cooling poultry in special trolleys was demonstrated on one of the Ministry's stands at the recent World's Poultry Congress at the Crystal Palace.

Under this system a trolley fitted with six troughs of the usual V-shape (see Figs. 1 and 2) is packed with poultry in the plucking room. The pressure necessary for shaping is applied by means of boards running lengthwise along the troughs and adjusted to give the required pressure by means of spring catches (AA). The trolleys illustrated were constructed for the Ministry by the Gloucestershire Marketing Society. As soon as it has been filled with poultry, the trolley is wheeled to the cooling room, where it is connected by a rubber hose to a small air compressing plant. Air at a pressure of from 20 to 30 lb. per sq. in. is led to six pipes (B,B), one fitted above the back edge of each of the shaping troughs. A series of small holes, say ten of $\frac{1}{32}$ in. diameter for a trolley 4 ft. 6 in. long, is provided in each of these pipes, so that the compressed air is directed obliquely downwards on to the poultry between the back of the trough and the pressing board, giving a steady flow of cool air around and between the birds. Each of the horizontal pipes is fitted with a stop-cock for purposes of regulation, and provision is also made for adjusting the tilt of the pipes so that any necessary alteration may be made to ensure the air jets striking the birds at the angle which will give the best results.

In practice, it is found that with the ordinary water-jacketed type of compressor, the air issuing from the jets is about 6° F. cooler than the air drawn in by the machine, and this allows of the birds being efficiently cooled in a comparatively short time. In addition, it is possible, if very quick cooling

is necessary, to cool the air while it is under pressure and so ensure very cold air after expansion at the jets.

Means are provided for filtering the air to remove all dust and excess moisture before it is allowed to come in contact with the birds.

The Ministry would be glad to answer inquiries regarding this apparatus from poultry farmers or packers who may be interested.

The Agricultural Marketing Bill.—*Need for Large-scale Marketing Organization.*—The marketing of home agricultural produce is distinguished by extreme individualism, the effects of which are discernible in the lack of harmony between supplies and market requirements both as to quantity and quality. The ultimate purpose of marketing organization in home agriculture as in other industries must, therefore, be the efficient adjustment of supplies, quantitatively or qualitatively, or both, to the demands of the market. This necessarily involves a comprehensiveness of plan and unity of execution such as can only be secured in the case of each home-produced commodity, or group of related commodities, by a body, whether trading or non-trading, which is able to regulate the marketing of home supplies as a whole, or, according to circumstances, the supplies of a particular area, and to exercise a conscious control of such supplies at the source.

Present Weaknesses.—The weaknesses of the present position are obvious. There is, for example, no large-scale marketing organization of home producers which is in a position to deal effectively with actual or potential surpluses in the case of milk, potatoes and hops, respectively, and it will be generally agreed that if the possible disorganization of the milk market, or a recurrence of bad years for potatoes* and hops, can be avoided and more stable market conditions secured by the all-embracing organization of the producers of these commodities, the effort should be made forthwith.

Milk.—In the case of milk, it is common knowledge that the price-negotiations conducted annually between the representative bodies of producers and distributors in England are tending to lose effect through the lack of that completeness of organization at the producers' end which only legislative backing can secure. The volume of milk offered to the fluid market is nearly always in excess of the consumptive demand and, in consequence, those producers who have difficulty in finding a market seek to overcome the difficulty by underselling.

* Such as the crop years 1928 and 1929.

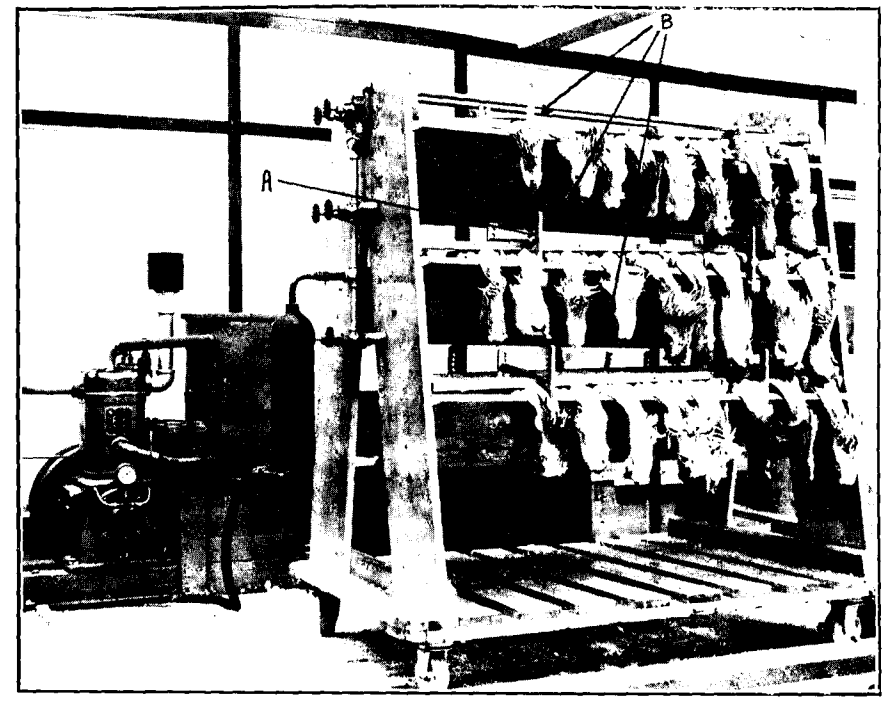

FIG. 1.—General view of the trolley and air compressing plant. A. Spring catch. B. Air pressure pipes.

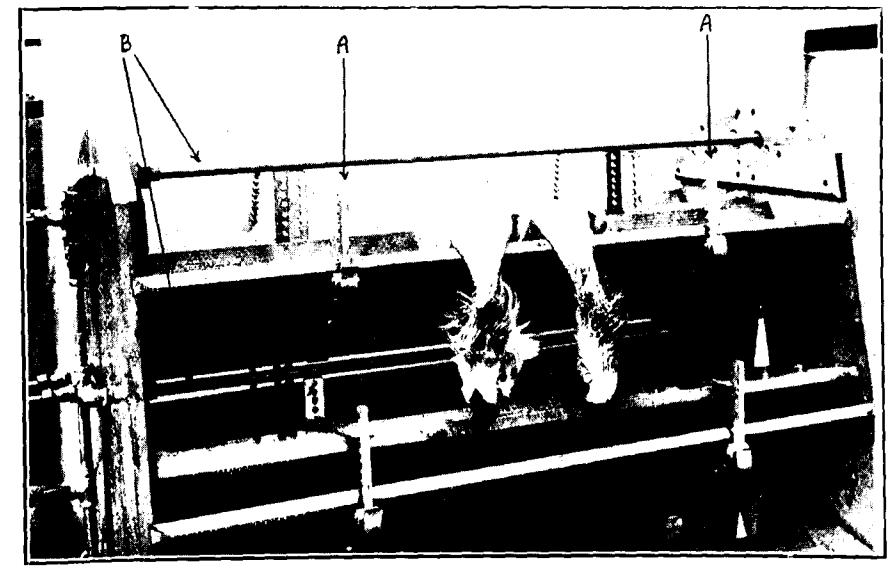

FIG. 2.—Detail view, showing spring catches (A—A) and air pressure pipes (B—B).

POULTRY SHAPING AND COOLING PLANT. EXHIBITED IN OPERATION AT THE WORLD'S POULTRY CONGRESS, 1930.

To face page 600.

A large-scale organization of producers, endowed with authority to secure the adherence of milk producers as a whole, and to require, *inter alia*, the registration of sale-contracts, would be in a position to protect the livelihood of all milk producers and to guarantee to distributors, whether consumers' co-operative societies or otherwise, that any price or other agreements entered into on behalf of its constituents would be duly and effectively observed. Precisely how such an organization would function in practice, in regard, for example, to the mobilization of funds from which to pay compensation for the manufacture of surplus milk into less valuable products, and to defray the cost of milk publicity, would be a matter for consideration.

Potatoes.—In the case of potatoes, it was not open ports but the inability of producers, in their present disorganized state, to deal effectively with a surplus, which caused the disastrous conditions from which potato growers have suffered in the last two seasons. When a surplus occurs, growers sustain enormous losses through low prices without consumers deriving any commensurate advantage. The problem of the recurring surplus can only be dealt with on national lines, and the organization of potato growers on a national scale is essential before any progress can be made. A surplus arises from wide variations in the annual *yields* per acre and its effect on price is altogether disproportionate to its extent. A large-scale organization of potato growers need not actually buy and sell the crop. Although its operations would naturally tend to economy in distribution costs, to the advantage of both producer and consumer, it might, to begin with, devote its energies primarily to diverting surplus stocks of potatoes into manufacturing channels for dried cattle-food, acetic acid, farina, etc., and develop export markets. The growers would, of course, need to provide funds for this purpose. A policy of this kind would lead to a considerable degree of price stabilization and, without detriment to the consumers' interests and in spite of competition from free imports, farmers should secure better cash returns on the average than they do in present circumstances.

Hops.—The hop-growing industry is also afflicted with the problem of a surplus. A hop growers' organization—English Hop Growers, Ltd.—was in operation for four years from 1925 to 1928 inclusive. To begin with, the organization had over 90 per cent. of the hop growers as members, but owing to storage and other charges involved in an orderly marketing policy,

some growers found that they could do better by joining the minority outside the organization and membership began to fall off. Eventually, owing to the gradual weakening of its control over the market, the society was compelled to discontinue operations. Since then, in spite of the existence of an import duty of £4 per cwt., home-grown hops have made only about £3 per cwt. on an average, and many are unsaleable. Until there is a large-scale organization endowed with compulsory powers in regard to any outstanding minority, it will be impossible to put the hop-growing industry on a sound economic basis.

General.—For nearly all home products, whatever the circumstances of production and marketing, there is, in fact, scope and need for a regulating organization to undertake the methodical feeding of the market according to a coherent plan. Such an organization, in complete control of supplies, would be in a position to extend adequate marketing credit to producers—a most important facility; it would aim at lowering the cost of distribution by eliminating unnecessary risk and waste and, with this object in view, it would, as far as practicable, not only offer a standardized article to the distributive trades, but regulate the flow of produce to market both as to time and place; it would be in a position to develop inter-trading relationships with the vast organization represented by the consumers' co-operative movement; it would be able to negotiate the terms and conditions under which its produce is handled at all stages; it could undertake national advertising and co-operate with wholesale and retail distributors generally in securing the most effective methods of shop display and sale.

The fact that most home products have to face the competition of imports and that, in such cases, the home producer can have little or no say as regards price, does not detract from the merit or necessity of this policy, which aims at securing that the home-produce tributary of the market stream shall, at its source, be under the same kind of unified control—whether of quality alone or of the time, rate and place of marketing—as that commonly exercised over imported supplies by overseas boards and other organizations which supply our market.

Minorities must be brought into Line.—While the need for action is generally admitted, the task of building up an effective organization on voluntary lines would be formidable. The task of holding together such an organization when

formed would be even more formidable so long as a minority of producers can stand by and leave others to carry the load which should, in fairness, be spread evenly over all. As shown by the experience of English Hop Growers, Ltd., a willing majority cannot, in fact, afford to be bound by a scheme which is being exploited by a minority. In the interests of producers as a whole, a dissident minority must be brought into line.

The Policy of the Bill.—The Agricultural Marketing Bill, which was introduced into the House of Commons on July 31, 1930, makes possible the large-scale organization of producers in the manner and for the purposes broadly indicated above. In preparing the Bill, for which there are precedents, as to type or principle, in the British Dominions, it was fully appreciated that farming opinion does not seek a remedy such as will involve direct regulation by the State. Through the Bill, the Government has, therefore, sought to provide the agricultural industry with machinery which is clearly needed—indeed, its provision, in some form or another, is inevitable—on the marketing side, but which the various commodity industries that make up the industry of agriculture may use or not at their discretion and to the extent that circumstances may require. The Bill is, therefore, optional inasmuch as it is for farmers, themselves, to submit the schemes which, if approved, will be mandatory on the producers concerned. The Bill, in effect, provides a legislative background of which farmers may make such use as they will, on their own initiative, to regulate the marketing of their own produce, either locally or nationally. It authorizes self-discipline, but its sanctions may only be applied by farmers to farmers. It creates no new criminal offences, since it does not permit of external disciplinary action of any kind against producers or any other section of the community.

Safeguards for Consumers and Others affected.—The Bill, which applies also to Scotland, confers wide powers upon organized farmers, and though these can only be applied by farmers to farmers yet their application cannot be without effect upon other interests. Great care has, therefore, been taken to provide public safeguards, particularly for the great body of consumers, and not excluding any minority of producers that may be involved. Such safeguards are definitely in the interests of organized farmers and are, in fact, desired by the more enlightened.

Marketing Funds: Government Assistance.—Provision is

also made in the Bill for the creation of Marketing Funds for which Parliament is asked to provide a sum of £625,000, from which both short-term and long-term loans may be made to boards set up by producers to administer commodity marketing schemes. It is anticipated that the more pressing need of these boards will be for initial funds with which they can make a quick start, and accordingly the Bill provides for the short-term loans to be free of interest, a concession which will be appreciated.

Conclusion.—The Government fully appreciates the significance and general economic importance of the standardization schemes for home produce which have been made possible by the Agricultural Produce (Grading and Marking) Act brought forward by the previous Government in 1928. Since the present Government came into Office, new schemes have been introduced under the Act and financial provision has been made for publicity for the standardized products. Standardization cannot, however, be made fully effective without organization; the two are, in fact, complementary. The Government, by the Agricultural Marketing Bill, is seeking to extend the horizon and to prepare the way for a great forward movement towards the goal of efficient marketing.

* * * * * *

THE BACON INDUSTRY

THE Minister of Agriculture and Fisheries, in issuing the following Report of the Pig Industry Council, hopes that it will secure the same wide publicity as was accorded to the Council's two previous Reports.

The Council considers that internal reform or organization of the industry is dependent upon and subsidiary to a scheme for restricting imports. The restriction of imports is, of course, contrary to the terms of the Geneva Convention and to our treaty obligations. In any event, while it is possible that, under a restriction scheme, bacon factories might have bigger supplies of bacon to offer, there is no reason to believe that they would have less irregular supplies unless some steps were taken to counteract the tendency to fluctuation in the pig population to which the pig industry is universally prone. In the Minister's view, organization of the industry is, therefore, the first necessity, whether or not restriction of imports, or a system of bulk purchase, is within the bounds of practical politics.

Even as it exists to-day, the Minister believes that substantial improvements can, in fact, be effected in the

pig industry, and that, as was suggested by the Council in its second interim report, economies can be achieved in production, marketing and manufacture. Further suggestions by the Council on this question will, therefore, be welcomed by the Minister, who is warmly appreciative of the valuable work towards this objective which the Council has already accomplished.

Report to the Minister of Agriculture and Fisheries by the Pig Industry Council.—In publishing the second interim report of the Pig Industry Council,* the Minister stated that he could not be "held to endorse any suggestions therein involving any prohibition or restriction of the importation of articles of food;" but that he had asked the Council "to continue with the task of exploring and assessing the economies which the pig industry can secure of itself, of recommending such action by the industry as will, in fact, secure these economies, of investigating the economic environment of competing bacon industries abroad, and generally pointing the way to a higher all-round standard of efficiency at home."

The Council now respectfully urges upon the Minister further consideration of the imperative need for some measure of control, regulation or restriction of imports of bacon. In the absence of such measure, the production of bacon pigs, no matter how highly organized or efficient, can only remain uncertain, and as a result the country will be faced with the virtual elimination of its home bacon trade.

Attention to all the advice the Council might be able to offer would afford no reasonable security that, after working for a year to breed and fatten a litter of pigs, the farmer would not have to suffer a substantial loss on his output owing to the flooding of the English market with imported bacon. The Council meets with this difficulty in every phase of its investigation.

The Council views with great alarm the position of the industry. Owing to the above-mentioned lack of reasonable security and to economic conditions, killings of English bacon pigs in 13 representative factories, during the first four months of 1924, 1925 and 1926, averaged only 46·5 per cent. of capacity. In the same period in 1927, 1928 and 1929, this figure decreased to 32·1 per cent. Taking the figures for the whole year, in 1924, 1925 and 1926, the average killings used only 52·2 per cent. of capacity, and in 1927, 1928 and 1929,

* Marketing Leaflet No. 16.

only 41·3 per cent. of the capacity of the same factories. Under these conditions no factory can be run economically, and this reacts to the disadvantage of the producer and consumer alike.

Though these figures show a greatly decreased production of English bacon, consumption has increased and has been met by adequate supplies of imported bacon. That these supplies of foreign bacon are almost certain to be increased is proved by the following extract from a statement by the Chairman at the Annual Meeting, on March 21, 1930, of Delegates from the Danish Co-operative Bacon Factories, taken from the *Andelsbladet* of April 4, 1930. At this meeting the Chairman, after quoting figures showing the increase in the pig population of Denmark, as shown by a census taken at the end of 1929 and the beginning of 1930, went on to say :—

> The number of pigs for export as bacon, to judge from these figures, will probably, in the course of the year, reach 120,000 to 125,000 pigs per week and the question now arises : Can we dispose of the whole of this increased quantity in England ? We hope so, and fortunately for us the pig population in England and Ireland has very considerably decreased, so much so that there is hardly any bacon production at the moment, as all the pigs can be sold as fresh pork at high prices. The English market can, no doubt, absorb somewhat more but we shall hardly escape a reduction in prices and these questions then arise : Do we do all we can to find new outlets and fresh markets ? Do we not take it too much for granted that the English market will always be ready to take the whole of our bacon production ? Ought we not already to look round and see if there are other countries to which the various pig products can be exported ? Is this not a problem for the Union* in connexion with the individual factory to take up ? Should these experiments cost a good deal in the beginning it would not be impossible for the Union to bear the expenses in connexion therewith. Everything that we can do to relieve the English market would be to our advantage.

For very many years past, as has been previously indicated, the lack of steady continuous supplies of pigs to English bacon factories has been acute. Each winter sees the bulk of available pigs slaughtered for the fresh pork market, with the result that, during the early months of each year, it is possible to secure only a small number of pigs for the home bacon trade. The consequence is that the bulk of the trade goes to our Continental competitors, who, having in this country a free and valuable market with practically no English competition, seize the opportunity further to extend their trade here.

* *i.e.*, The Union of Danish Co-operative Bacon Factories.

The foreigner is thus increasing his hold upon the bacon trade in this country. In selling bacon, as in the case of any other article, a market can be created only by service. If a buyer cannot rely on supplies from one source he looks for another one, and having found it, he keeps it. The measure of the sale for English bacon must always depend on regularity of output.

It is now two years since the Council was constituted, and it is necessary to emphasize the principal point of its terms of reference, which are as follows :—

> To consider the circumstances affecting pig production in England and Wales, with special reference to methods of marketing and to the requirements of the home market, and to make recommendations from time to time with the object of *increasing the home production both of pork and bacon.*

During the intervening period the members of the Council have met repeatedly, and a vast amount of time and labour has been devoted to discussions of breeds and types, systems of litter testing, animal hygiene, veterinary inspection, and other kindred aspects of the subject. But, although such considerations are of a certain limited value and importance, they are all dependent upon, and entirely subsidiary to, the one great essential necessary to success, and that is a sound foundation on which to build. This cannot exist without some feeling of security that efficient pig production will yield a reasonable profit.

The Council desires, therefore, to record its emphatic opinion that it is not justified in recommending any steps for the increase of pig production unless this first and most vital factor, which in its opinion dominates the whole situation, is given immediate precedence.

Having carefully and anxiously explored every avenue likely to lead to the greater and more continuous production of pigs, the Council can see one solution, and one only, likely to produce those beneficial results which its constitution was designed to secure. In the Council's judgment that solution lies in ensuring that the pig producer is not from time to time placed at the mercy of foreign competitors and compelled to market his bacon pigs at a serious loss.

This involves action by the British Government to regulate and control the import of foreign bacon and pig products, produced under economic conditions which have no counterpart in this country.

Germany has recently passed a law, the effect of which is so to raise import duties as virtually to prohibit the importa-

tion of meat supplies. Any such restriction of imports means that an ever-increasing volume of foreign products will be sent to this country as being virtually the only free dumping ground where every foreign nation is permitted to dominate our home market.

In the Council's judgment it is vital that the Government should not wait until these further threatened dangers are actually upon the country, but should move to secure the immediate increase of home-produced supplies of pigs by a reasoned and equitable system of control or restriction of foreign imports of bacon and pig products.

Hitherto the loss sustained by farmers in marketing cereals and potatoes has been one of the most potent causes of the agricultural depression from which we are now suffering. The course now recommended would provide English farmers with a sure and certain means of utilizing their grain, and of turning it to direct profit.

This Council has already expressed its opinion that it is only in the bacon trade that expansion can be looked for in the industry,* and has also given the Minister its considered estimate of the increase in employment possible by the establishment of a flourishing bacon industry.† The Council is of opinion that the measures now being urged on the Minister will not be to the detriment of the consumer, and that they are absolutely essential not only to the expansion of pig production, but even to its continued existence as an important section of the agricultural industry. The well-being of the pig industry is of vital importance to the whole agricultural community. It is hopeless to expect to set the industry on its feet and materially increase production until confidence has been established and the farmer convinced that he can have some reasonable expectation of a return for his enterprise and capital outlay. The Council, therefore, most respectfully urges the Minister to reconsider this question, and at once initiate those measures which, in the Council's view, constitute the only means of averting a disaster to that section of the agricultural industry with which the Council is dealing, a disaster which would inevitably react on the whole.

FOLKESTONE, *Chairman*,
May 21, 1930.

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* Marketing Leaflet No. 16, pp. 4 and 5.
† *Ibid.* p. 8.

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1930

ACREAGE UNDER CROPS AND GRASS AND NUMBERS OF LIVE STOCK ON HOLDINGS ABOVE ONE ACRE IN EXTENT IN ENGLAND AND WALES AS RETURNED BY OCCUPIERS ON JUNE 4, 1930.
(*The figures for* 1930 *are subject to revision.*)

CROPS AND GRASS

Distribution	1930	1929	Increase		Decrease	
	Acres	*Acres*	*Acres*	*Per cent.*	*Acres*	*Per cent.*
TOTAL ACREAGE under all CROPS and GRASS ..	25,379,000	25,438,000	—	—	59,000	0·2
*ROUGH GRAZINGS ..	5,293,000	5,283,000	10,000	0·2	—	—
ARABLE LAND ..	9,834,000	9,948,000	—	—	114,000	1·1
PERMANENT GRASS:						
For Hay ..	5,051,000	4,696,000	355,000	7·6	—	—
Not for Hay	10,494,000	10,794,000	—	—	300,000	2·8
TOTAL ..	15,545,000	15,490,000	55,000	0·4	—	—
Wheat	1,346,000	1,330,000	16,000	1·2	—	—
Barley	1,026,000	1,120,000	—	—	94,000	8·4
Oats	1,773,000	1,854,000	—	—	81,000	4·4
Mixed Corn ..	131,300	140,400	—	—	9,100	6·5
Rye	44,300	34,400	9,900	28·8	—	—
Beans, harvested as corn ..	162,200	144,400	17,800	12·3	—	—
Beans, picked or cut green ..	13,500	12,600	900	7·1	—	—
Peas, harvested as corn ..	79,500	78,600	900	1·1	—	—
Peas, picked or cut green ..	56,200	53,900	2,300	4·3	—	—
Potatoes ..	422,600	518,800	—	—	96,200	18·5
Turnips & Swedes	671,300	699,400	—	—	28,100	4·0
Mangold ..	288,500	299,200	—	—	10,700	3·6
Sugar Beet ..	346,700	229,900	116,800	50·8	—	—
Cabbage for fodder, Kohl-rabi and Rape ..	134,300	124,700	9,600	7·7	—	—
Vetches or Tares	74,600	67,900	6,700	9·9	—	—
Lucerne.. ..	39,800	35,800	4,000	11·2	—	—
Mustard for seed	26,000	23,100	2,900	12·6	—	—
Cabbage for human consumption ..	30,800	32,400	—	—	1,600	4·9
Brussels sprouts	26,500	26,700	—	—	200	0·7
Cauliflower or Brocoli ..	14,900	13,900	1,000	7·2	—	—
Carrots	9,100	10,300	—	—	1,200	11·7

* Mountain, Heath, Moor, Down and other rough land used for grazing.

CROPS AND GRASS—*continued.*

Distribution	1930	1929	Increase		Decrease	
	Acres	*Acres*	*Acres*	*Per cent.*	*Acres*	*Per cent.*
Onions	2,000	2,400	—	—	400	16·7
Celery	6,400	5,600	800	14·3	—	—
Rhubarb ..	7,700	7,200	500	6·9	—	—
Linseed	4,000	3,100	900	29·0	—	—
Hops	20,000	24,000	—	—	4,000	16·7
Small Fruit ..	66,200	64,900	1,300	2·0	—	—
Orchards ..	247,000	248,400	—	—	1,400	0·6
CLOVER and ROTATION GRASSES:						
For Hay ..	1,594,000	1,524,000	70,000	4·6	—	—
Nor for Hay ..	830,000	845,000	—	—	15,000	1·8
TOTAL ..	2,424,000	2,369,000	55,000	2·3	—	—
BARE FALLOW ..	294,800	325,400	—	—	30,600	9·4

The area covered by the annual returns made as on June 4, 1930, by occupiers of agricultural holdings exceeding one acre in extent in England and Wales is 30,672,000 acres, revealing a net loss of agricultural land of 49,000 acres since June, 1929. The area returned as under crops and permanent grass is 25,379,000 acres, or 59,000 acres less than in 1929, while the acreage of rough grazings is 5,293,000 acres, which shows an increase of 10,000 acres. The arable acreage returned was 9,834,000 acres, and while this acreage shows a further reduction of 114,000 since last year, the decrease was appreciably less than that shown in any of the three preceding years. There was again an increase in the area under permanent grass which, at 15,545,000 acres, was 55,000 acres more than in 1929.

While the arable area has thus continued to shrink the acreage left as bare fallow was also again less than in the previous year (the reduction being 30,600 acres), so that the area returned as actually under crops in June, 1930, other than clover and rotation grasses was 138,000 acres less than last year.

The area under corn crops (including beans and peas harvested as corn) shows a reduction of 140,000 acres, a small increase in the wheat and rye acreages and in the areas of beans and peas harvested for corn being heavily outbalanced by reductions in the area under barley, oats and mixed corn. Potatoes and roots show a reduction in acreage of 96,000 acres and 39,000 acres respectively, while sugar beet shows a remarkable increase of 117,000 acres or over 50 per cent. The acreage under vegetables as a whole shows a decrease; an addition to the acreage under small fruit is more than counterbalanced by a slightly heavier decrease in orchards, and the area under hops is less by about 4,000 acres.

Cereals.—The acreage under the principal cereal crops—wheat, barley, oats and mixed corn—shows a net decrease of about 170,000 acres, a small increase in the acreage under wheat being heavily discounted by reductions in the acreage under the other three crops. The area under wheat was 1,346,000 acres, or 16,000 acres (1·2 per cent.) larger than in 1929, a small but welcome increase in view of the great shrinkage of the area under this crop in the last ten years. More than half of the counties returned increased acreages under this crop, and these were mainly in the North Eastern, Eastern, East Midland and the two northern divisions. Norfolk returned nearly 5,000 acres more than in 1929, and Lincolnshire a net increase of nearly 3,000 acres. There was a reduction of 1,400 acres in the East Riding, but an increase amounting to 5,800 acres in the other two Ridings.

The barley acreage, which shrank by 65,000 acres last year, showed a further substantial reduction of 94,000 acres (8·4 per cent.) and at 1,026,000 acres was the smallest area ever recorded. The decrease was general throughout the country, no county of importance in regard to this crop recording any increase. The Norfolk barley area was reduced by 13,000 acres, the Yorkshire area by 9,000 acres, and the Lincolnshire area by 10,000 acres, while Essex and Suffolk returned acreages which were smaller by 7,000 acres and 11,000 acres respectively. The increase of 92,000 acres shown in the acreage under oats last year was almost eliminated by a reduction of 81,000 acres (4·4 per cent.) this year, the total acreage returned under oats being 1,773,000 acres. Practically every county in England and one-half of the Welsh counties returned smaller acreages than in 1929, the heaviest reductions being 8,000 acres in Norfolk, 5,000 acres in Lancashire, while the three Ridings of Yorkshire together lost 17,000 acres.

The area under mixed corn was 131,000 acres, which, although 9,000 acres less than in 1929, was still above the acreage of this crop for any other year since 1924. Nearly one-half of the acreage under this crop is in the South-Western division which returned a small increase of over 1,000 acres. Otherwise decreases were general practically throughout the country.

There was again an increase in the area under rye, which at 44,000 acres was 10,000 acres more than in 1929. While almost every county contributed to this increase, the most notable addition was 1,500 acres in Nottingham.

Beans and Peas.—The total area under beans was 176,000 acres, and was larger than that of 1929 by about 19,000 acres (12·0 per cent.). The increase was mainly in the area to be harvested as corn, which was 162,000 acres, or 18,000 acres more than in 1929. Larger acreages under this crop were returned by practically all counties except in the Northern and South-Western Divisions, where decreases were general. Beans to be picked green were grown on 13,000 acres, an increase of 1,000 acres (7·1 per cent.) compared with the area returned in 1929. The acreage under peas again showed an increase although rather less than that of last year. The total acreage was 136,000, the increase being 3,000 acres, mainly in the area to be picked green, which was 56,000 acres, or 2,300 acres more than in 1929. The area to be harvested as corn was 79,000 acres, or 900 acres larger than in 1929.

Potatoes.—The acreage returned as under potatoes was 423,000 acres, which was 96,000 acres (18·5 per cent.) less than in 1929, and is the smallest acreage under this crop since 1910. With one negligible exception decreases were general in all counties. The heaviest reductions were in Lincolnshire which returned 24,000 acres less than in 1929, Yorkshire with 11,000 acres less, and Lancashire and the Isle of Ely with 6,000 acres and 7,000 acres respectively less than in 1929.

Sugar Beet.—An increase of 117,000 acres (50·8 per cent.) in the area under sugar beet has brought the acreage to 347,000 acres. Except for trifling decreases in three northern counties and one in Wales increases were general throughout the country. The bulk of the increase was shown in the Eastern and North-Eastern divisions which between them returned 93,000 acres more than in 1929. The largest county increases were 28,000 acres in Lincolnshire; 21,000 acres in Norfolk;

13,000 acres in Suffolk; and 12,000 acres in the Isle of Ely. Outside these two divisions the most important increase was that of 5,000 acres in Salop.

Fodder Roots.—The area under turnips and swedes was further reduced by 28,000 acres (4 per cent.) to 671,000 acres. Except in the North-Western division where the majorities of counties showed an increase, smaller acreages were general almost throughout the country, the largest decrease being that of 6,000 acres in Norfolk. The very small increase shown in the area under mangolds in 1929 was not maintained and the area of 288,000 acres returned this year is 11,000 acres or 3·6 per cent. smaller than in 1929. The counties showing the greatest decreases were Yorkshire 1,300 acres, Salop 1,030 acres and Norfolk 1,415 acres.

Vegetables.—The majority of vegetables were grown on reduced areas, the most notable exceptions being cauliflower and broccoli which show an increase of 1,000 acres to 14,900 acres, while the acreages of celery and rhubarb were increased by 800 acres to 6,400 acres and by 500 acres to 7,700 acres respectively. Cabbage for human consumption was grown on 30,800 acres or 1,600 acres less than in 1929, while the area under brussels sprouts at 26,500 was only very little less than in the previous year. The acreage of onions was reduced by 400 acres and that of carrots by 1,200 acres.

Other Crops.—There were increases in the acreages of fodder cabbage, kohl-rabi and rape, the total area under these crops being 134,300 acres, or 9,600 acres larger than in 1929. Vetches, lucerne and mustard for seed were also grown on increased acreages, the additions being 6,700 acres, 4,000 acres and 2,900 acres, respectively. The hop acreage shows a reduction of 4,000 acres or nearly 17 per cent., the area returned being 20,000 acres.

Fruit.—While the total acreage of orchard and small fruit remains little changed in extent as compared with last year, there was a loss in the orchard acreage of 1,400 acres which was almost counterbalanced by an increase of 1,300 acres in the area under small fruit. The principal variations in orchard acreages were increases of 901 acres in Kent and 648 acres in Hereford, while decreases were recorded of 590 acres, 572 acres and 563 acres in Devon, Somerset and Gloucester, respectively. Most counties contributed to the increase in the acreage of small fruit, the largest additions being 334 acres in Lincs (Holland), 185 acres in Essex and 161 acres in Kent.

Clover and Rotation Grasses and Meadow Hay.—The total acreage returned as under clover and rotation grasses was 2,424,000 acres, which is 55,000 acres more than in 1929. The proportion of this acreage returned as intended for hay is 1,594,000 acres, an area larger by 70,000 acres than that contributing to the hay harvest of 1929. The acreage of meadow hay was returned as 5,051,000 acres, or 355,000 acres more than in the previous year, and the total area, therefore, from which the hay crop of 1930 will be taken is 6,645,000 acres, showing an increase of 425,000 acres on that of 1929.

Bare Fallow.—The favourable conditions which existed for cultivation in 1928 were again prevalent in 1929, and the large decrease in the area left for bare fallow in the previous year was followed by a further reduction of some 30,600 acres. The total acreage returned this year was 294,800 acres, the smallest area recorded since 1912.

LIVE STOCK

The numbers of live stock on agricultural holdings on June 4, 1930, again showed reductions as compared with the previous year, with the exception of sheep, which showed an increase of 1·4 per cent. The reductions in the case of cattle and pigs were 1.9 per cent. and 2·6 per cent. respectively, against 1 per cent. and 20 per cent. in 1929,

while the decrease in the number of horses, at 3·8 per cent., was the same as that shown last year.

CATTLE.

	1930	1929	Increase		Decrease	
	No.	*No.*	*No.*	*Per cent.*	*No.*	*Per cent.*
Cows and Heifers in milk ..	2,028,600	2,054,100	—	—	25,500	1·2
Cows in Calf, but not in milk ..	289,000	293,700	—	—	4,700	1·6
Heifers in Calf ..	352,500	364,800	—	—	12,300	3·4
Other Cattle :—						
Two years and above.. ..	972,900	999,200	—	—	26,300	2·6
One year and under two ..	1,116,700	1,143,600	—	—	26,900	2·4
Under one year	1,086,300	1,102,200	—	—	15,900	1·4
TOTAL OF CATTLE	5,846,000	5,957,600	—	—	111,600	1·9

The total decrease in the number of cattle was 111,600. As was the case last year, the falling off was relatively least in the dairy herd as a whole, the reduction of 25,500 in the number of cows and heifers in milk representing a loss of 1·2 per cent. and that of 4,700 in the case of cows in calf, but not in milk, a loss of 1·6 per cent. Heifers in calf, on the other hand, showed a reduction of 12,300, or 3·4 per cent., the decrease in this class being relatively the heaviest among the various classes of cattle.

The reduction in the numbers of other cattle varied from 1·4 per cent. in the case of those under one year, which were fewer by 15,900 than in 1929, to 2·6 per cent. in the case of those two years old and above which were reduced by 26,300. The reduction in the number of other cattle between one and two years old was 26,900 or 2·4 per cent. The number of dairy cattle in Wales showed an increase, but throughout England there were fewer in the great majority of the counties, small increases being returned by a few counties, notably Devon, Norfolk, and in most of the northern counties. As regards other cattle, decreases were shown by the majority of counties, except in the South-Western division, in the number of cattle under one year old, and two years and over, while in the case of cattle between one and two years old the South-Eastern division and the West Midland and South-Western divisions returned increased numbers.

SHEEP

	1930	1929	Increase		Decrease	
	No.	*No.*	*No.*	*Per cent.*	*No.*	*Per cent.*
Ewes kept for Breeding ..	6,806,000	6,717,300	88,700	1·3	—	—
Other Sheep :—						
One year and above .. .	2,453,300	2,454,000	—	—	700	·03
Under one year	7,069,300	6,934,200	135,100	1·9	—	—
TOTAL OF SHEEP	16,328,600	16,105,500	223,100	1·4	—	—

The reductions of 673,000 and 294,000 in the number of sheep which occurred in 1928 and 1929 were followed in 1930 by an increase of 223,100. The number of breeding ewes showed an increase of 88,700, or 1·3 per cent., in contrast to a reduction of 129,700 in 1929. The number of other sheep was practically unchanged in regard to those one year old and above, but in the case of sheep under one year there was an increase of 135,100, or 1·9 per cent. The increase in the number of breeding ewes was mainly confined to the Northern and Western divisions of the country and to Wales, where most of the counties returned larger numbers, but in the North-Eastern, Eastern, East Midland and South-Eastern divisions the number of breeding ewes showed a decrease. The increase in the number of sheep under one year old was distributed over much the same areas as in the case of breeding ewes, but in the case of sheep one year old and above the North-Western division and North Wales shared in the decrease shown in this class of sheep.

PIGS

	1930	1929	Increase		Decrease	
	No.	*No.*	*No.*	*Per cent.*	*No.*	*Per cent.*
Sows kept for Breeding ..	315,000	307,100	7,900	2·6	—	—
Other pigs ..	1,990,700	2,059,400	—	—	68,700	3·3
TOTAL OF PIGS..	2,305,700	2,366,500	—	—	60,800	2·6

The total number of pigs returned on June 4 again showed a reduction from that of the previous year, but the decrease which was 60,800, or 2·6 per cent., was small compared with the reduction of 604,500, or 20 per cent., shown in 1929. There was an increase in the number of breeding sows, which were 7,900, or 2·6 per cent. more than in the previous year, while the number of other pigs showed a decrease of 68,700, or 3·3 per cent. There were increases in both classes of pigs in the Northern and North-Western divisions and in Wales, and while net increases were shown in the number of breeding sows in the North-Eastern, West Midland and South-Western divisions the remainder of the country returned fewer.

HORSES

	1930	1929	Increase		Decrease	
	No.	*No.*	*No.*	*Per cent.*	*No.*	*Per cent.*
Horses used for Agricultural purposes (including Mares for Breeding) ..	682,600	706,800	—	—	24,200	3·4
Unbroken Horses (including Stallions):—						
One year and above ..	89,300	92,100	—	—	2,800	3·0
Under one year	37,900	37,600	300	0·8	—	—
Other Horses ..	151,300	162,800	—	—	11,500	7·1
TOTAL OF HORSES	961,100	999,300	—	—	38,200	3·8

The total number of horses on agricultural holdings continues to decline, the reduction of 38,200 (or 3·8 per cent.) shown this year being relatively equivalent to that recorded in 1929. The number of horses used for agricultural purposes (including mares for breeding) declined by 24,200, a figure which does not differ substantially from the reduction in this class shown last year, and while there was a reduction of 2,800 in the number of unbroken horses one year and above, the number of foals is very little different from that returned last year. The decline in the number of foals which has slackened in the last few years has apparently been checked.

AGRICULTURAL WORKERS

	1930	1929	Increase		Decrease	
Regular Male Workers:—	*No.*	*No.*	*No.*	*Per cent.*	*No.*	*Per cent.*
21 years old and over	445,500	451,700	—	—	6,200	1·
Under 21 years old	118,800	125,300	—	—	6,500	5·
TOTAL ..	564,300	577,000	—	—	12,700	2·
Casual Male Workers:—						
21 years old and over	69,800	79,600	—	—	9,800	12
Under 21 years old	10,700	11,300	—	—	600	5
TOTAL ..	80,500	90,900	—	—	10,400	11
TOTAL MALE WORKERS, REGULAR & CASUAL	644,800	667,900	—	—	23,100	
Women and Girls:						
Regular Workers	65,400	67,000	—	—	1,600	
Casual Workers	31,600	35,400	—	—	3,800	1
TOTAL ..	97,000	102,400	—	—	5,400	
TOTAL WORKERS ALL CLASSES ..	741,800	770,300	—	—	28,500	

The total number of agricultural workers showed a reduction 28,500, or nearly 4 per cent., to which all classes contributed. P portionately the smallest decrease was in regular male adult work which amounted to 6,200, or about 1½ per cent. The number of cas male adult workers on the other hand declined by 9,800, or o 12 per cent., and of casual female workers by 3,800, or nearly 11 cent.

HOPS

Acreage of Hops.—Preliminary statement compiled from the retu collected on June 4, 1930, showing the acreage under Hops in e County of England in which Hops were grown, with a compara statement for the years 1929 and 1928.

Counties, &c.		1930	1929	1928
		Acres	Acres	Acres
Kent ..	East	2,650	3,310	3,280
	Mid	3,610	4,900	4,940
	Weald	5,510	6,660	6,580
	Total, Kent ..	11,770	14,870	14,800
Hants		870	1,010	990
Hereford		3,690	3,860	3,780
Surrey		140	160	160
Sussex		1,700	2,140	2,150
Worcester		1,730	1,810	1,790
Other Counties		70	130	130
TOTAL		19,970	23,980	23,800

* * * * * *

SEPTEMBER ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,
Director of Agriculture for West Sussex.

Rotation of Crops.—In the normal four-course rotation, the land after a wheat crop is subjected to cleaning and tilling operations to destroy weeds and to improve the physical condition of the soil. In most cases, a root or other cleaning crop is taken in what may be described as the cleaning year of the rotation; this may be potatoes, which are grown for their cash value as well as the opportunity they afford for cleaning the land; in other cases sugar beet is cultivated for a like purpose, and has an advantage over potatoes in that the tops are of considerable value as stock food and, when fed off on the land, improve its manurial condition. Where mangolds are grown the roots are usually carted off, but the tops remain and are of considerable manurial value, especially when evenly spread and ploughed under in a fairly fresh condition. The grower of potatoes, sugar beet or mangolds manures the land with farmyard manure and a complete dressing of mineral manures to ensure the most profitable return from these crops; in each case there is a manurial residue which should benefit succeeding crops. The two-fold object of the cleaning year is thus obtained.

An area approximately equal to that devoted to potatoes, sugar beet and mangolds is sown with turnips, swedes, cabbage, kale or rape. The great bulk of this produce is fed off on the land by sheep. In many cases the swedes, turnips and rape are grown without farmyard manure, but with such mineral

manures as circumstances demand. The supply of farmyard manure may not extend to the whole area under roots, and the fields may be so far removed from yards and buildings where the manure is made as to make it impracticable for the manure to be carted to them. In these cases the aim is to provide a cleaning crop, a food for stock and a means of improving the manurial condition of the land by the residues from the sheep. On the lighter and poorer soils great stress is laid on the last-named benefit, and a failure of the root crop is not regarded so seriously from the point of view of the shortage of stock food as the insufficient manurial dressing which is a consequence and which affects the cropping capacity of the land for a whole rotation.

In favourable circumstances some of the area cleared of roots can be sown with autumn-sown wheat, and this is often advantageous in that it ensures a better crop of grain than might be obtained from a spring-sown crop. On the other hand an autumn-sown grain crop is less suited as a "nurse" for seeds of clovers and grasses. The major portion of the root area is devoted to spring-sown grain crops in the following year, and in this crop the seeds for the clover and hay crop are sown.

The spring-sown grain crop is a weak link in the rotation. The growth of barley of good malting quality may provide remunerative returns, and there are conditions under which this may be the pivotal crop, yet the greater area is devoted to oats or barley of feeding quality only, and such crops seldom yield sufficiently well to pay for the direct cost of their cultivation as well as the beneficial cultivations and manurial residues from the previous cropping; consequently succeeding crops must compensate for this deficiency.

The hay crop in the rotation is varied in character; in some cases red clover only is sown, or, alternately in the rotation, a mixture of trefoil and white clover is taken to avoid the too frequent use of red clover and the occurrence of clover sickness. One-year leys may also consist of a mixture of rye-grasses and clovers, and where the ley is to remain for more than one year a varied mixture of grasses and clovers is used. The hay crop is grown at a minimum of expenditure. The total return per acre may be of small value, but it is not unusual for the net returns to compare favourably with the other crops in the rotation, and the hay crop may be regarded as at least self-supporting. Its influence on the succeeding crop will depend on the extent to which clover,

and in particular red clover, was a constituent. A pure red clover ley is an excellent preparation for a wheat crop. The presence of rye-grass is regarded as injurious to the wheat crop, and many farmers refuse to use rye-grass in their mixture or prefer to follow a rye-grass mixture with oats rather than wheat. The reason would appear to be that the soil is insufficiently supplied with nitrogen where rye-grass has predominated, and what is present is used by soil organisms in breaking down the organic matter and not available for the early growth of the grain crop. Oats are affected as well as wheat, but the consequences seem less. There is need for experiment as to the amount and kind of manure which would counteract the effects produced by rye-grass mixtures.

In a four-course rotation, using pure clover as a hay crop, practically the whole of the benefits due to the accumulation of organic matter are concentrated on the grain crop immediately following. Each crop in the rotation so far has contributed benefits to its successor, but this cannot be claimed for the grain crop which follows the clover. It is the climax and when it is harvested the whole procedure of preparing for another rotation has to begin over again. Rotations may be lengthened or modified in various ways, but it is necessary to take into consideration the benefits an individual crop confers on its successors or its ability to utilize economically the benefits conferred by preceding crops. Wheat as usually grown does not confer benefits, but responds to benefits handed down.

Wheat.—In spite of the low price obtained for wheat in recent times this crop is an important one to the arable farmer. A considerable area of the arable land in eastern and southern England is kept under the plough by the use of wheat as a pivotal crop.

In preparing for wheat it is necessary to remember that wheat likes solid ground; early ploughing and allowing the land to consolidate may partly account for the preference farmers have for a "stale" furrow. Where ploughing is deferred the use of a furrow presser is a common feature in the Southern Counties, and Kent is noted for the practice of cartwheeling, which fulfils the same purpose as the furrow presser. Furrow pressing is most important on the lighter soils, both chalks and sands. The writer has seen a field on a light loamy soil where the only wheat that survived the winter was in the tracks of the wheels of a cart which crossed the field loaded with seed wheat at sowing time. When land

is furrow pressed the seed can be broadcast and is easily covered without harrowing the land down to a fine condition. On heavy soils pressing may do harm if the work is done when the soil is wet, and lack of surface drainage may severely injure the wheat during a wet period.

The method of ploughing the land varies with the type of soil. Adequate surface drainage must be allowed for; on the stiffest of clays the land is ploughed in narrow "lands" or "stetches," sometimes as narrow as eight feet or sufficient to enable a drill to take a width between the open furrows. On easier working land, the width between the open furrows is made wider. With the more general use of tractors, the tendency has been to widen the space between the open furrows, with the result that in many cases the wheat has suffered. Water furrowing is often necessary even on light land. The skilful drawing of a few furrows across the slope of a field to convey surface water easily and quickly off the field makes a very material difference to the average yield. These furrows not only take away surface water but they prevent the excessive washing down of material on sloping fields.

There is a wide range of time during which wheat can be sown, from late September until Christmas and again in February, March, and even April. On the poorest and wettest of clay soils, and on land which is bare fallowed, late September sowing is desirable; the only real drawback to early sowing on such soils is that these types are often infested with slender foxtail grass, commonly called black grass. This is a difficult weed to contend with, and whilst later sowing would allow of the destruction of the surface weeds which have germinated, such a delay would often be fatal to the seeding of the wheat. On most soils October and November are suitable months, and the middle of October is highly favoured.

A farm foreman after 42 years' experience on a medium loam in Sussex told the writer that all the outstanding crops he could remember were drilled between October 15 and 20.

The quantity of seed will vary with the nature of the land and the time of sowing. Early sowing and a good tilth require less seed; the range may be between 2 and 4 bushels. Instances have been noticed where by accident as small a quantity as one bushel has been sown, and where this was sown early the crop proved excellent. If it were possible to ensure the equal distribution of a small seeding and the growth of every seed, a single bushel of seed would be more than enough,

but with the drills at present in use and the heavy losses which take place between the sowing of the seed and the vigorous growth in April, it would not be safe to advise, generally, such small seedings.

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NOTES ON FEEDING STUFFS

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Home-Grown Foods.—When the prices of their produce are low, farmers have to consider very carefully the question whether it will pay better to feed it to stock instead of selling it and buying in other feeding stuffs. Feeding of home-grown foods eliminates the expense of delivery and saves carting cake, so that the policy of making all the produce walk off the farm has much to recommend it. It is simply a question of price plus a realization of the limitations of the various foods. As to the former, figures based on the latest quotations are provided below these notes each month. In what follows, roots, silage, grass, etc., are omitted, since their general nature justifies the usual policy of consuming them on the farm that grows them. The difficulty of decision arises chiefly in the case of cereals and pulses, and, more rarely, with potatoes.

It must always be realized that a low price is not enough to make any food desirable: however low the price, money will still be wasted if animals are fed on unsuitable feeding stuffs. This aspect must be kept carefully in mind, for with low cereal prices farmers are apt to feed them unwisely, forgetting their low protein content. A generous provision of carbohydrate without an adequate allowance of protein is unsound policy, so that with classes of stock that require much of the latter —cows and growing animals—there is a relatively low limit to the amount of cereals that can be used. Fortunately, beans and peas are much richer in protein than cereals, and their addition to the mixture will help to balance it up; nevertheless, their protein is not sufficiently high to warrant admixture with really large quantities of cereals. In many cases, therefore, it is more economical to purchase a certain amount of a really rich food, such as decorticated cotton seed meal or decorticated ground nut cake; 1 lb. of either of these will balance up 3 lb. of cereals, whereas beans can only balance their own weight.

For fattening cattle a large part of the ration may be home-grown if, but only if, a good allowance of hay is provided.

With straw and roots there will be a shortage of protein, and only by the use of bought, protein-rich concentrates can a ration containing much cereal be satisfactorily adjusted. As fattening proceeds, however, the extra food needed will be starchy material, and this is where cereals can be usefully employed.

A fair proportion of cereals can also be included in rations for dairy cows, except for the highest yielders. Oats are good, but have not a high enough starch equivalent for the best

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended August 6				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) .. *	9 7*d*	9 7*d*	9 7*d*	9 7*d*	12 1
Nitro-chalk (N. 15½%) .. *	9 19*d*	9 19*d*	9 19*d*	9 19*d*	12 10
Sulphate of ammonia :— Neutral (N. 20·6%) .. *	10 2*d*	10 2*d*	10 2*d*	10 2*d*	9 10
Calcium cyanamide (N. 20·6%) *	9 6*e*	9 6*e*	9 6*e*	9 6*e*	9 0
Kainit (Pot. 14%) .. .. §	3 6	2 19	2 19	2 18	4 2
Potash salts (Pot. 30%) .. §	5 3	4 18	5 0	4 11	3 0
,, (Pot. 20%) .. §	3 15	3 9	3 8	3 6	3 4
Muriate of potash (Pot. 50%) §	9 17	9 3	9 2	8 12	3 5
Sulphate,, ,, (Pot. 48%) §	11 19	11 6	11 5	10 7	4 4
Basic Slag (P.A. 15¾%)‖ .. §	2 13*c*	2 3*c*	..	2 9*c*	3 1
,, (P.A. 14%)‖ .. §	2 7*c*	1 16*c*	1 16*c*	2 3*c*	3 2
,, (P.A. 11%)‖ .. §	..	1 9*c*	1 9*c*	..	..
Ground rock phosphate (P.A. 26-27½%)‖ .. .. .. §	2 2*a*	2 10*a*	2 5*a*	2 7*a*	1 9
Superphosphate (S.P.A.16%) §	3 11	..	3 9	3 6	4 2
,, (S.P.A.13¾%) §	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3¾%, P.A.20½%) §	8 15	8 10	8 7	6 15	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%) .. .. §	5 17*b*	5 15*f*	6 10	4 7	..

Abbreviations: N. = Nitrogen; P.A. = Phosphoric Acid; S.P.A. = Soluble Phosphoric Acid; Pot. = Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 80% through standard sieve. *a* Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lot at purchaser's nearest railway station.

f Delivered Yorkshire stations.

milkers, and consequently tend to make the mixture too bulky. Wheat and barley give heavy meals and tend to become pasty in the stomach, and consequently should be used very moderately. There is a belief among practical men that barley tends to dry the milk up, but this has never been definitely proved. In general, if it is required to include the greatest possible amount of cereals in the ration it will be found better to add a little of the dearer, rather than much of the cheaper, purchased concentrates.

For pigs it is common to use large quantities of barley meal and millers' offals, and crushed wheat can be substituted for the latter if the price is low. A large proportion of the ration can be in the form of cereals, and the protein balance can be maintained by the addition of quite small quantities of fish meal, etc. Separated milk and whey are excellent for pigs, and it is well known that one of the mainstays of the Danish system of agriculture is the production of bacon from skimmed milk and cereals. With pigs, again, a lower proportion of protein can be included later on in the fattening period. In Denmark the ration used in pig testing stations for pigs 8 weeks old contains about 30 per cent. of its nutrients in the form of skimmed milk and 70 per cent. as cereals, but as the pigs get older more cereals and less skimmed milk are used, and by the time of slaughter the percentages are 15 and 85 respectively.

A few years ago a comprehensive experiment was carried out at the Harper Adams Agricultural College by Crowther and Chalmers to ascertain what were the best home-grown foods for pigs. In all, 12 lots of 10 pigs each were included: they were between 10 and 16 weeks old at the beginning of the trial, and the experimental feeding was continued for 20 weeks. The most striking result was the very beneficial effect of separated milk and whey; the pigs receiving these averaged about 1½ lb. a day live weight increase over the whole period, as compared to about ¾ lb. to 1 lb. for the other pens. If separated milk was included, a simple mixture of wheat and barley was satisfactory, and nothing was gained by adding oat, bean or pea meal to it. The experiment agreed with Danish practice in showing the great value of a ration consisting of cereals and separated milk. After the rations containing separated milk and whey (and there seemed little to choose between these two) the most effective were mixtures containing cereals and beans or peas. This would be expected as the addition of pulses would help to balance up the cereals.

Three of the pens were fed on cereals alone, and it was concluded that satisfactory rations could not be made up from them: the rations were all low in protein, containing less than 0.4 lb. per pig per day. As regards the particular cereals, oats were found to be definitely bad. Considerable difficulty was experienced in getting the pigs to clear them up, this difficulty being only overcome by thorough grinding of the oats. The live weight gain was disappointing. In view of the fact that the pig has no special means of dealing with fibre it is only to be expected that a husky grain like the oat would be bad, and its use for pigs can hardly ever be worth while.

As regards the feeding of potatoes, some farmers have found during the last year or two that home consumption is the only way of getting rid of them. Their analysis shows 75 per cent. of water and 21 per cent. of carbohydrates; in addition they contain a small proportion of protein-like substances, but these are mostly ammonia compounds of little nutritive value. Potatoes contain acrid substances which act as irritants in the body and may, if they are being fed in large quantities, cause scouring. They also increase the flow of saliva abnormally, and it can often be seen dripping in stringy threads from the mouth. A small proportion of a definite poison—solanine—is present, but the only real danger from this is when the potatoes are sprouting: the solanine is concentrated in the young sprouts (also, to a certain extent, when greening of tubers occurs), making them dangerous to eat. In view of the objectionable substances mentioned above it is better to cook, or at least to steep, potatoes before feeding: cooking is the best as it makes the starch more easily digestible (potato starch is in the form of characteristically large grains). In the stomach, potatoes ferment readily and tend to produce much gas.

Potatoes should be introduced very gradually into the ration, and should never be fed above a certain amount. Cattle have been fed successfully with as much as 50 lb. a day, and can deal with them in their raw state rather better than other stock. Milking cows should not receive so much, and 25 lb. should be regarded as the limit, especially as they tend to produce butter of poor flavour. In substituting potatoes for mangolds it must be remembered that their starch equivalent is more than twice as high as that of mangolds. Sheep may be given 2 or 3 lb. a day, but no more. For horses it is generally recommended that 5 lb. a day should be about the maximum,

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	8 5	0 11	7 14	72	2 2	1·16	9·6
Barley, British feeding	—	—	6 10	0 9	6 1	71	1 8	0·89	6·2
„ Danubian	18 0	400	5 0*	0 9	4 11	71	1 3	0·67	6·2
„ Persian	17 9	„	5 0	0 9	4 11	71	1 3	0·67	6·2
„ Russian	18 9	„	5 5	0 9	4 16	71	1 5	0·76	6·2
Oats, English, white	—	—	6 5	0 10	5 15	60	1 11	1·03	7·6
„ „ black and grey	—	—	5 15†	0 10	5 5	60	1 9	0·94	7·6
„ Argentine	15 9	320	5 10	0 10	5 0	60	1 8	0·89	7·6
„ Chilian	16 0	„	5 12	0 10	5 2	60	1 8	0·89	7·6
„ German	20 6	„	7 3	0 10	6 13	60	2 3	1.20	7·6
Maize, Argentine	32 3	480	7 10	0 9	7 1	81	1 9	0·94	6·8
„ South African	30 6	„	7 2	0 9	6 13	81	1 8	0·89	6·8
Peas, Japanese	—	—	15 15§	1 0	14 15	69	4 3	2.28	18
Dari	—	—	8 0	0 11	7 9	74	2 0	1·07	7·2
Milling offals—									
Bran, British	—	—	4 10	1 0	3 10	42	1 8	0·89	10
„ broad	—	—	4 15	1 0	3 15	42	1 9	0·94	10
Middlings, fine, imported	—	—	5 15	0 16	4 19	69	1 5	0·76	12
„ coarse, British	—	—	5 10	0 16	4 14	58	1 7	0·85	11
Pollards, imported	—	—	4 17	1 0	3 17	60	1 3	0·67	11
Meal, barley	—	—	7 0	0 9	6 11	71	1 10	0·98	6·2
„ maize	—	—	7 15	0 9	7 6	81	1 10	0·98	6·8
„ „ South African	—	—	6 5	0 9	5 16	81	1 5	0·76	6·8
„ „ germ	—	—	6 10	0 14	5 16	85	1 4	0·71	10
„ locust bean	—	—	7 10	0 7	7 3	71	2 0	1·07	3·6
„ bean	—	—	10 15	1 4	9 11	66	2 11	1·56	20
„ fish	—	—	18 0	3 1	14 19	53	5 8	3·04	48
Maize, cooked flaked	—	—	8 17	0 9	8 8	83	2 0	1·07	8·6
„ gluten feed	—	—	6 15	0 19	5 16	76	1 6	0·80	19
Linseed cake, English, 12% oil	—	—	10 5	1 8	8 17	74	2 5	1·29	25
„ „ „ 9% „	—	—	9 10	1 8	8 2	74	2 2	1·16	25
„ „ „ 8% „	—	—	9 5	1 8	7 17	74	2 1	1·12	25
Soya bean cake, 5½% oil	—	—	8 12*	1 19	6 13	69	1 11	1·03	36
Cottonseed cake—									
„ „ English, 4½% oil	—	—	4 15	1 6	3 9	42	1 8	0·89	17
„ „ Egyptian, 4½% „	—	—	4 7	1 6	3 1	42	1 5	0·76	17
Ground-nut cake, 6-7% oil	—	—	6 10†	1 6	5 4	57	1 10	0·98	27
Decorticated ground-nut cake, 6-7% oil	—	—	7 15†	2 0	5 15	73	1 7	0·85	41
Palm kernel cake, 4½-5½% „	—	—	5 5†	0 17	4 8	75	1 2	0·62	17
„ „ „ meal, 4½% „	—	—	5 15†	0 17	4 18	75	1 4	0·71	17
„ „ meal 1-2% oil	—	—	5 0†	0 17	4 3	71	1 2	0·62	17
Feeding treacle	—	—	6 7	0 8	5 19	51	2 4	1·25	2·7
Brewers' grains, dried ale	—	—	4 15	0 17	3 18	48	1 7	0·85	13
„ „ „ porter	—	—	4 5	0 17	3 8	48	1 5	0·76	13
Malt culms	—	—	6 0§	1 5	4 15	43	2 3	1·20	16

* At Bristol. † At Hull. § At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of July and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £7 per ton, then since its manurial value is 17s. per ton as shown above, the food value per ton is £6 3s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 1s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0·89d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 9s. 0d.; P_2O_5, 2s. 10d.; K_2O, 3s. 0d.

but in one American inquiry no harm resulted from giving horses as much as 17½ lb.

Pigs seem to provide the best outlet if potatoes must be used on the farm, and during the past year they have figured widely in pig rations. For young pigs they are not suitable because of the possible risk of their rather "unsafe" components, and also because they are too starchy for growing

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6·2	5 2
Maize	81	6·8	7 6
Decorticated ground nut cake	73	41·0	7 15
„ cotton cake	71	34·0	8 10

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·64 shillings, and per unit protein equivalent, 1·45 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES.

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	6 12
Oats	60	7·6	5 9
Barley	71	6·2	6 5
Potatoes	18	0·6	1 10
Swedes	7	0·7	0 12
Mangolds	7	0·4	0 12
Beans	66	20·0	6 17
Good meadow hay	37	4·6	3 7
Good oat straw	20	0·9	1 14
Good clover hay	38	7·0	3 12
Vetch and oat silage	13	1·6	1 4
Barley straw	23	0·7	1 19
Wheat straw	13	0·1	1 1
Bean straw	23	1·7	2 0

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C.2, price 6d. net.

animals, as they contain practically no flesh-forming nutrients. In general potatoes should not be used for pigs younger than about 4 months. If cooked before use, and if they are introduced gradually into the ration, as much as 12 to 15 lb. a day may be permitted for older pigs. Several trials have been made both in America and on the Continent to compare them with meals. In one it was found that 440 lb. of maize meal were equivalent to 262 lb. of maize meal plus 786 lb. of potatoes, both producing 100 lb. increase in live weight. Thus, 786 lb. of potatoes gave the same return as 178 lb. of maize meal, this being in conformity with the general experience that something like 4 lb. of potatoes are equivalent to 1 lb. of the common meals.

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MISCELLANEOUS NOTES

Courses at County Farm Institutes

THERE are at present 17 farm institutes in England and Wales. The primary object of these institutes is to provide instruction in the scientific principles underlying sound farming practice, and they have been specially and extensively equipped for the purpose. The instruction given is closely related to practice; this applies not only to general agriculture, but also to market gardening, fruit-growing, dairying and poultry-keeping. The subjects dealt with and their order of importance vary somewhat at the different institutes, but a typical curriculum includes the following: soils, manures, crops, live stock, feeding stuffs, implements and machinery, veterinary hygiene, surveying and mensuration, farm book-keeping, general agricultural science (biology and chemistry), horticulture, dairying, poultry-keeping, bee-keeping, and fungus and insect pests. Most of the courses start in October, one term being taken before Christmas and one after, but in some cases a full year's course is provided. Facilities are also provided for short courses in special subjects, and most of the institutes provide instruction for women—particularly in such subjects as dairying, horticulture and poultry-keeping.

The institutes are situated in the following counties: Cheshire (at Reaseheath, near Nantwich); Cumberland and Westmorland (at Newton Rigg, near Penrith); Essex (at Chelmsford); Hampshire (at Sparsholt, near Winchester); Hertfordshire (at Oaklands, St. Albans); Kent (at Borden, near Sittingbourne); Lancashire (at Hutton, near Preston); Lincolnshire, Holland (at Kirton, near Boston); Northamptonshire (at Moulton, Northampton); Somerset (at Cannington, near Bridgwater); Staffordshire (at Rodbaston, Penkridge); West Suffolk, the Chadacre Agricultural Institute (at Hartest, Bury St. Edmunds); East Sussex (at Plumpton); Caernarvonshire (at Madryn Castle, Bodfean); Carmarthenshire (at Pibwrlwyd, Carmarthen); Denbighshire (at Llysfasi, Ruthin); and Monmouthshire (at Usk, Newport).

A certain number of scholarships tenable at the institutes are awarded by the various County Councils to residents within their areas, and the Ministry itself awards scholarships thereat for the sons and daughters of agricultural workers.

Brief particulars of the courses for the session 1930-31 are contained in a leaflet (Form No. 732/T.E.), which can be obtained from the Ministry; more detailed information will be furnished by the Principal of the Institute concerned. Anyone desirous of attending one of the courses commencing in October should make immediate application to the Principal.

* * * * * *

The Agricultural Index Number

THE general index number of the prices of agricultural produce in July was 3 points higher on the month at 34 per cent. above the base years 1911–13 as compared with 41 per cent. a year ago. Wheat, barley, oats and hay showed a further fall in price during July, but the effect of this fall was more than counterbalanced by the increased values for milk, eggs and potatoes.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925:—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	37
May	57	50	42	54	44	34
June	53	48	41	53	40	31
July	49	48	42	45	41	34
August	54	49	42	44	52	—
September	55	55	43	44	52	—
October	53	48	40	39	42	—
November	54	48	37	41	44	—
December	54	46	38	40	43	—

Grain.—The average prices of wheat, barley and oats were lower on the month by 3d., 6d. and 2d. per cwt. respectively and in each case the index showed a fall. Wheat was 5 points lower at 2 per cent. above pre-war, while barley declined by 8 points and oats by 4 points to 12 per cent. and 20 per cent., respectively, below the level of the base years.

Live Stock.—A slight decline was recorded in the prices of fat cattle and fat pigs, but fat sheep were unaltered either in price or index number. In the case of fat cattle the fall of 1s. per live cwt. was less than that which occurred in the corresponding period in the base years and the index was consequently higher by 3 points at 30 per cent. above pre-war. Bacon pigs were 6 points lower at 40 per cent. and pork pigs 3 points lower at 49 per cent. above the level of 1911–13. Dairy cows were appreciably dearer, the average price rising by over £1 per head and the index by 3 points to 32 per cent. above the base years. Store cattle, sheep and pigs were cheaper, as is customary at this period of the year, but store cattle and sheep prices did not fall to the same extent as in July, 1911–13, and the indices rose by 1 and 13 points to 29 per cent. and 78 per cent., respectively, above pre-war. Store pigs fell one point to 100 per cent. above the level of the base years.

Dairy and Poultry Produce.—The indices for milk and butter rose on the month by 3 and 7 points, respectively, to 58 per cent. and 31 per cent. in excess of the pre-war level as compared with 57 per cent. and 52 per cent. a year ago, but a considerable fall in the price of cheese reduced the index number by 10 points to 32 per cent. above pre-war as compared with 67 per cent. a year earlier. Eggs were about 3½d. per dozen dearer than in June and the index rose by 15 points to 44 per cent. above the level of the base years, but poultry was rather cheaper, a fall of 10 points to 47 per cent. being recorded.

Other Commodities.—The prices realized in July for first early potatoes were 23 per cent. higher than in July, 1911–13, as compared with a figure of 4 per cent. below pre-war recorded last year. Hay prices were reduced by from 4s. to 5s. per ton during July and the index was 7 points lower at 18 per cent. above pre-war, as against 29 per cent. in July, 1929. Fruit as a whole was considerably cheaper this July than last, the general index being 34 per cent. in excess of the base years as compared with 73 per cent. in the previous year. Vegetables, however, were slightly dearer both on the month and year. Wool prices declined a little further to 4 per cent. below the pre-war level.

Index numbers of different commodities during recent months and in July, 1928 and 1929, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13.

Commodity	1928	1929	1930			
	July.	July.	Apl.	May.	June.	July.
Wheat	34	28	14	11	7	2
Barley	37	30	Nil	—1*	—4*	—12*
Oats..	58	23	—11*	—11*	—16*	—20*
Fat cattle	44	30	33	30	27	30
Fat sheep	66	55	56	63	66	66
Bacon pigs	41	64	76	61	46	40
Pork pigs	34	61	80	67	52	49
Dairy cows..	34	33	30	29	29	32
Store cattle..	31	25	24	28	28	29
Store sheep..	67	60	43	46	65	78
Store pigs	25	80	113	108	101	100
Eggs	36	57	40	28	29	44
Poultry	54	57	55	64	57	47
Milk	55	57	58	55	55	58
Butter	50	52	30	23	24	31
Cheese	81	67	41	52	42	32
Potatoes	37	—4*	—39*	—36*	—40*	23
Hay	11	29	30	28	25	18
Wool	78	45	3	Nil	—1*	—4*

* Decrease.

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Scholarships, Fellowships and Grants

Post-Graduate Agricultural Scholarships.—On the recommendation of the Advisory Committee on Agricultural Science, post-graduate agricultural training scholarships have been awarded to the following :—

Name	*Subject*
E. L. Jones ..	Agricultural Economics
L. C. Couch ..	Animal and Crop Husbandry with special reference to animal husbandry
R. W. R. Miller ..	Crop Husbandry
Miss A. A. Nichols..	Dairying (one year only)

Research Scholarships.—On the recommendation of the Advisory Committee on Agricultural Science, research scholarships have been awarded to the following :—

Name	*Subject*
G. M. Wickens ..	Plant Pathology
W. F. Jepson ..	Entomology
S. Gladstone-Solomon	Helminthology
J. S. Steward ..	Veterinary Science
R. Grant	Animal Genetics
M. H. French ..	Animal Nutrition
B. I. Felton ..	Agricultural Economics

The agricultural scholarships are usually tenable for two, and the research scholarships for three, years. The second year, or third year, as the case may be, is usually spent abroad. The value of each scholarship is £200 in the first year; extra travelling and subsistence expenses may be paid in the year which is spent abroad. Scholars' fees are also paid.

Travelling Research Fellowships and International Conference Grants, 1930.—On the recommendation of the Advisory Committee on Agricultural Science, the following awards have been made :—

Name	*Institute or College*	*Country and Period*	*Purpose*	*Amount*
Pease, M. S.	Small Animal Breeding Institute, Cambridge	Germany, August 23-27, 1930	International Conference on Rabbit Breeding, Leipzig	£30
Parkhurst, Prof. R. T.	National Institute of Poultry Husbandry, Newport, Salop	do.	do.	20
Glynne, Miss M. D.	Rothamsted Experimental Station, Harpenden, Herts	Germany, end September to end October, 1930	Study of wart disease problems and methods of infection and to confer with German workers	45

* * * * * *

THE following note has been communicated by the National Institute of Agricultural Botany. The records collected by the National Institute of Agricultural Botany from its trial stations, from County Agricultural Organizers, and from farmers themselves not only provide reliable and unbiassed knowledge about the merits of varieties, but prove that a wider application of this knowledge would substantially improve the yield and quality of crops over wide areas. The following notes do not necessarily apply to the North of England, but in other districts they may be accepted with some confidence. Those who wish to have fuller particulars than are given here can obtain them by writing to the Institute at Cambridge.

Varieties of Cereals for Autumn Sowing

Winter Wheats

The mild, wet and windy winter, the heavy storms in the early summer, and the prolonged rains of July and August

not only separated the strong-strawed from the weak, but favoured the development of such diseases as foot-rot and whiteheads. The knowledge of the reaction of wheat varieties to these diseases is far from complete, but there is no reason to believe that any one variety is markedly more resistant or more susceptible to them than another. The season has also reminded growers that winter-hardiness means something more than mere resistance to frost; wind and rain can play their part in thinning the plant and it was noticeable that Scandinavian and Dutch varieties, bred in more rigorous climates, were, with few exceptions, less adapted than such a variety as Squarehead's Master to survive successfully the conditions which prevailed last winter.

The value of change of seed is another subject of perennial interest. It may help farmers to know that, given seed of equal purity and germination, there is no definite evidence that Scandinavian or Continental-grown stocks will give better results than stocks of the same variety grown in England. The introduction of Scandinavian varieties has incidentally led to some confusion in names; the usual practice has been to translate the original foreign name into its English equivalent, but in one instance entirely different English names have been used. Thus Millennium, Monarch and Red Chaff Squarehead wheats are Danish-grown stocks of Crown, Steel and Squarehead's Master respectively. The same thing applies in the case of a "January White Oat," which is Danish-grown Victory oats, and of a "Two-rowed Winter Malting Barley" which is Danish-grown Victory barley.

The Institute is no less anxious than seed-merchants and farmers to find improved varieties, but it sees no reason at present to vary the recommendations given in previous years. Wilhelmina or Victor are the most reliable high-yielding varieties on soils in good condition; Yeoman or Yeoman II possess unique bread-making quality and are the varieties to grow on the richest soils or under intensive manuring; Little Joss should be chosen for the lighter wheat soils, particularly in Norfolk, or where fertility is low; Iron III, though less reliable than Wilhelmina and apt to develop rust, finds a place, like Weibull's Standard, on heavy soils. Rivett, or Blue Cone, probably outyields all other varieties on heavy soils in the South of England, and Squarehead's Master stands by itself in its adaptability to all sorts of conditions and the regularity with which it gives a respectable crop.

Most of the other varieties which are likely to be on the market this autumn have either not yet been sufficiently tested to be recommended or they lack any distinguishing superiority over the older or better known kinds.

Winter Oats

The farmer who wants to be sure of his crop year in year out can choose only one variety, Grey Winter. It has one serious defect, weak straw. Such slight advantage as Black Winter may have on this score is offset by a degree or two of inferiority in resistance to frost and quality of grain. There is no winter-hardy white oat on the market. If strength of straw is essential the least risky variety to choose is the black-grained Bountiful.

Winter Barley

The ordinary six-row winter barley almost always gives a satisfactory crop, but the grain is not of malting quality. None of the two-row malting types is winter-hardy, but Plumage-Archer and Spratt-Archer can be sown without much risk if exposed situations and ill-drained soils are avoided. They generally succeed and when they do the yield and quality are substantially better than in the case of spring-sown crops.

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The Hannah Dairy Research Institute.—The offices of the Hannah Dairy Research Institute have now been transferred from Glasgow to the Institute's permanent headquarters at Auchincruive, Ayr.

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Enforcement of Minimum Rates of Wages.—During the month ending August 14 legal proceedings were instituted against seven employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines £ s. d.	Costs £ s. d.	Arrears of wages £ s. d.	No. of workers involved
Somerset ..	Langport ..	—	1 3 0	17 0 0	1
Somerset ..	Langport ..	Case dismissed			1
Wiltshire ..	Wootton Bassett ..	2 0 0	—	15 6 8	1
Yorks W.R...	Knaresborough	0 5 0	0 2 6	6 3 11	1
Glamorgan ..	Swansea ..	4 0 0	—	11 2 6	1
Radnor ..	Clyro	0 10 0	0 6 6	17 0 0	1
Radnor ..	Clyro	1 0 0	0 10 6	1 18 6	1
		£7 15 0	£2 2 6	£68 11 7	7

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Lancashire : Miss W. W. Young has been appointed Assistant Instructress in Poultry Keeping, *vice* Miss M. L. Sinclair.

Lincolnshire (Lindsey) : Mr. A. McVicar, B.Sc., N.D.A., N.D.D., has been appointed Agricultural Organizer, *vice* Mr. J. A. McMillan, B.Sc.

Norfolk : Mr. J. C. Mann, M.A., has been appointed Assistant Director of Agricultural Education.

Mr. G. H. Bates, B.Sc., has been appointed Senior Instructor in Agriculture.

Mr. C. E. Grainger has been appointed Instructor in Commercial Horticulture.

Mr. E. V. Beard has been appointed Junior Instructor in Poultry Keeping.

Northamptonshire : Mr. H. L. Webb, B.A., has been appointed Assistant Agricultural Organizer and Warden of the Farm Institute at Moulton, *vice* Mr. A. McVicar, B.Sc., N.D.A., N.D.D.

Mr. R. O. Wood, B.Sc., has been appointed Junior Assistant in Agriculture.

Surrey : Mr. R. Line, B.Sc., N.D.A., has been appointed Assistant Agricultural Organizer, *vice* Mr. G. T. Morgan, N.D.A., N.D.D.

Miss N. Butchart, N.D.D., B.D.F.D., has been appointed Assistant Instructress in Small Livestock.

Yorkshire (Agricultural Department, University of Leeds): Mr. A. B. Bates, B.Sc., N.D.A., and Mr. W. W. Ballardie, B.Sc., N.D.D., have been appointed District Lecturers in Agriculture.

Mr. H. J. Moore, B.Sc., N.D.A., has been appointed Assistant Lecturer in Agriculture, *vice* Mr. W. B. Nicoll, B.Sc.

Mr. R. Duncan has been appointed Instructor in Horticulture.

Mr. J. Grainger, B.Sc., has been appointed Assistant Lecturer in Horticultural Botany, *vice* Mr. A. S. Galt.

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SELECTED CONTENTS OF PERIODICALS

Agriculture, General and Miscellaneous

Meteorology in Agriculture. (Int. Rev. Agric. (Part I. Mon. Bull. Agric. Sci. and Pract.) XXI, 1 (Jan., 1930), pp. 1–3.) [551.5.]

The Utilisation of Refuse. (Int. Rev. Agric. (Part I., Mon. Bull. Agric. Sci. and Pract.), XXI, 1 (Jan., 1930), pp. 22–32.) [63.164 ; 63.60432 ; 668.6.]

A Suggested Method for the Utilisation of Seaweed. *T. Dillon* and *E. F. Lavelle*. (Econ. Proc. Roy. Dublin Soc. II, 24 (Sept., 1928), pp. 407–413.) [63.165.]

Soil Survey of Wales, Progress Report, 1927–29. *G. W. Robinson, D. O. Hughes* and *B. Jones*. (Welsh Jour. Agric., Vol. VI (1930), pp. 249–265.) [63.111.]

The Agricultural Ladder and the Age of Farmers. *A. W. Ashby* and *J. L. Davies*. (Welsh Jour. Agric., Vol. VI (1930), pp. 5–19.) [331.]

Horse Labour on Welsh Farms, 1871–1927. *J. L. Davies*. (Welsh Jour. Agric., Vol. VI (1930), pp. 42–53.) [63.191 ; 63.61.]

Studies of Vitamin C in Fresh and Canned Tomatoes. *B. Clow* and *A. L. Marlatt*. (Jour. Agric. Res., 40, 9 (May 1, 1930), pp. 767–775.) [543.1 ; 63.513 ; 664.84.]

Agricultural Economics, Co-operation, etc.

The Agricultural Credits Act, 1928. *L. le M. Minty.* (Econ. Jour., Vol. XL, No. 158 (June, 1930), pp. 248–258.) [332.71 (42).]

Rent and Stock Carrying Capacity of some Welsh Farms. *J. Pryse Howell* and *P. George.* (Welsh Jour. Agric., Vol. VI (1930), pp. 20–42.) [333.5 (429); 338.1 (429); 63.6.]

Research Relating to Co-operative Marketing. *O. B. Jesness.* (Jour. Farm. Econ., XII, 2 (April, 1930), pp. 233–247.) [334.6.]

A Review of Agricultural Co-operation in Wales. *J. Morgan Jones.* (Welsh Jour. Agric., Vol. VI (1930), pp. 54–67.) [334 (429).]

The Future of Co-operative Bacon Factories in England. *David Black.* (Pig Breeders' Ann., 1930–31, pp. 28–31.) [334.6; 63.752.]

Field Crops

Variation in the Quality of Wheat Grown in Replicate Plots. *R. Newton* and *J. G. Malloch.* (Scientific Agriculture, X, 10 (June, 1930), pp. 669–677.) [63.311.]

Investigations on Yield in Cereals. VII.: A Study on Development and Yield of Wheat Based upon Varietal Comparison. *F. L. Engledow* and *K. Ramiah.* (Jour. Agric. Sci., XX, 2 (April, 1930), pp. 265–344.) [63.31; 63.311.]

Sugar Beet Costs in North Wales. *J. Pryse Howell.* (Welsh Jour. Agric., Vol. VI (1930), pp. 86–108.) [63.3433 (42).]

Pasture

A Comparative Study of the Effects of Artificial Manures on the Botanical Composition of the Herbage in an Old Pasture. *E. Jones.* (Welsh Jour. Agric., Vol. VI (1930), pp. 198–208.) [63.33; 63.33–16.]

The Recovery of Nitrogen in Pastures from the Application of Nitrogenous Manures. *T. W. Fagan* and *R. O. Davies.* (Welsh Jour. Agric., Vol. VI (1930), pp. 208–223.) [63.33; 63.33–16.]

The Effect of Cutting Sainfoin at Different Stages on the Yield and Chemical Composition of Hay and Aftermath. *T. W. Fagan* and *J. Rees.* (Welsh Jour. Agric., Vol. VI (1930), pp. 224–237.) [63.33; 63.60433.]

Nationality Trials with Cocksfoot and Observations on the General Bearing of the Relationship of Stem Shoots to Leaf Shoots. *R. G. Stapledon.* (Welsh Jour. Agric., Vol. VI (1930), pp. 130–140.) [63.33.]

Perennial Rye-Grass at Aberystwyth. *T. J. Jenkin.* (Welsh Jour. Agric., Vol. VI (1930), pp. 140–165.) [63.33.]

The Effect of Different Cutting and Manurial Treatments on the Tiller and Root Development of Cocksfoot. *R. G. Stapledon* and *W. E. J. Milton.* (Welsh Jour. Agric., Vol. VI (1930), pp. 166–174.) [63.33; 63.33–16.]

The Influence of Date of Sowing on the Permanency of Certain Legumes as Constituents of Pastures. *M. T. Thomas.* (Welsh Jour. Agric., Vol. VI (1930), pp. 175–182.) [63.33.]

The Effect of Cutting to the Ground Level upon the Growth of Established Plants of *Dactylis glomerata* and *Phleum pratense.* *M. A. H. Tincker.* (Welsh Jour. Agric., Vol. VI (1930), pp. 182–198.) [63.33.]

Fruit

Physiology of Fruit. I.: Changes in the Respiratory Activity of Apples During their Senescence at Different Temperatures. *F. Kidd* and *C. West.* (Proc. Roy. Soc., Series B., Vol. 106, No. B742 (Feb. 5, 1930), pp. 93–109.) [58–11; 63.41–198; 664.85.]

Progress Report on Fruit Breeding. *G. T. Spinks.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 12–16.) [63.1952; 63.41.]

Families of Strawberry Seedlings Bred for Resistance to Aphis. *G. T. Spinks.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 17–27.) [63.27; 63.41.]

Self-Fertility and Self-Sterility in Cider Varieties of Apples. *G. T. Spinks.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 28–33.) [58.11; 63.41.]

Root Regeneration upon Transplanted Apple Rootstocks. *T. Swarbrick.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 40–46 + 4 pl.) [63.41–195; 63.41.]

The Shape and Quality of Apples in Relation to their Position in the Fruit Cluster: Progress Report. *J. C. Hinton* and *T. Swarbrick.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 67–72 + 1 pl.) [63.41.]

Cider-Making

Cider-Making Trials for the Season 1928–29. *O. Grove.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 176–195.) [663.3.]

The Effects of Low Temperature Storage on Cider. *B. T. P. Barker* and *O. Grove.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 196–199.) [663.3.]

Some Trials with New Types of Cider Filters. *O. Grove.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 200–203.) [663.3.]

Plant Pests and Remedies

Crinkle "A," an Infectious Disease of the Potato. *R. N. Salaman.* (Proc. Roy. Soc., Series B., Vol. 106, No. B741 (Jan. 14, 1930), pp. 50–83, pl. 1–4.) [63.23.]

Para-Crinkle: a Potato Disease of the Virus Group. *R. N. Salaman* and *R. H. Le Pelley.* (Proc. Roy. Soc., Series B., Vol. 106, No. B742 (Feb 5, 1930), pp. 140–175, pl. 13–17.) [63.23.]

Studies on Potato Virus Diseases. VII.: Some Experiments with the Virus of a Potato Crinkle with Notes on Interveinal Mosaic. *K. M. Smith.* (Ann. App. Biol. XVII, 2 (May, 1930), pp. 223–240, pl. XVII–XX) [63.23.]

The Chlorotic Disease of the Hop. *E. S. Salmon* and *W. M. Ware.* (Ann. App. Biol. XVII, 2 (May, 1930), pp. 241–247, pl. XXI and XXII) [63.23.]

Streak—A Virus Disease of Tomatoes. *P. H. Jarrett.* (Ann. App. Biol. XVII, 2 (May, 1930), pp. 248–259.) [63.23.]

The Control of Cucumber and Tomato Mosaic Diseases in Glasshouses by the Use of Clean Seed. *W. F. Bewley* and *W. Corbett.* (Ann. App. Biol. XVII, 2 (May, 1930), pp. 260–266.) [63.294; 63.23.]

Spraying Trials against Apple Scab. II.: Season 1929. *J. G. Maynard* and *R. W. Marsh.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 155–165.) [63.24.]

Supplementary Note on the Control of Black Currant Leaf Spot. *R. W. Marsh* and *J. G. Maynard.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 166–167.) [632.4.]

Dry-Rot of Swedes: Second Progress Report. *T. Whitehead.* (Welsh Jour. Agric., Vol. VI (1930), pp. 289–295.) [63.24.]

Control of Root Flies in South Wales. *H. W. Thompson.* (Welsh Jour. Agric., Vol. VI (1930), pp. 295–301.) [63.27.]

The Common Green Capsid Bug (*Lygus pabulinus*) as a Pest of Sugar Beet. *C. L. Walton* and *L. N. Staniland.* (Ann. Rept.

Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 99–100+1 pl.) [63.27.]

The Raspberry and Loganberry Beetle and its Control: Some Experiments with a Pyrethrum Emulsion Spray. *C. L. Walton.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 115-123.) [63.27; 63.295.]

Experiments on the Control of Pear Midge (*Contarinia pyrivora*). Progress Report. *L. N. Staniland* and *C. L. Walton.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 124-129.) [63.27.]

On the Biology of the Gall-Midges (Cecidomyidae) attacking Meadow Foxtail Grass (*Alopecurus pratensis*), including the Description of one New Species. *H. F. Barnes.* (Ann. App. Biol. XVII, 2 (May, 1930,) pp. 339-366.) [63.27.]

Insects found associated with Cacao, Spices and Dried Fruits in London Warehouses. *O. W. Richards* and *G. V. B. Herford.* (Ann. App. Biol., XVII, 2 (May, 1930), pp. 367-395, pl. XXIII-XXXII.) [63.27.]

Observations on the Diseases of Market Garden Crops in the Vale of Evesham. *L. Ogilvie.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 149-154.) [63.23; 63.24-51; 63.27-51.]

The Economics of Spraying Fruit Trees. II.: The Cost of Summer and Winter Washing, 1929 and 1930. *J. G. Maynard.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 168-175.) [63.294; 63.41.]

Investigations on the Fungicidal Action of Sulphur. IV.: Third Progress Report. *B. T. P. Barker.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 130-148+1 pl.) [63.295.]

Further Observations on a Pyrethrum Spray Fluid. *F. Tutin.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 93–95.) [63.295.]

Examination of Plants for Insecticidal Principles—I. *F. Tutin.* (Ann. Rept. Long Ashton Agric. and Hort. Res. Stn., 1929, pp. 96-98.) [63.295.]

The Principles of Biological Control. *W. R. Thompson.* (Ann. App. Biol., XVII, 2 (May, 1930), pp. 306-338.) [63.296.]

Live Stock and Feeding

The Production and Marketing of Pigs in North Wales and Cardigan. *T. Lewis.* (Welsh Jour. Agric., Vol. VI (1930), pp. 67-86.) [63.6 : 38; 63.64.]

Reproductive Disturbances caused by Feeding Protein-deficient and Calcium-deficient Rations to Breeding Pigs. *H. R. Davidson.* (Jour. Agric. Sci., XX, 2 (April, 1930), pp. 233-264.) [612; 612.394; 63.64 : 043.]

The Value of Sugar-beet Pulp and Potatoes in Pig Feeding. *J. A. Thompson.* (Pig Breeders' Annual, 1930-31, pp. 129-131.) [63.60432; 63.64 : 043.]

Observations on the Nutrition of Breeding Pigs. *J. B. Orr* and *H. R. Davidson.* (Pig Breeders' Ann., 1930-31, pp. 53-57.) [612.394; 63.64 : 043.]

Feeding Ensilage to Sheep: Some Successful Experiences by Farmers. (New Zealand Jour. Agric., XL, 4 (April 22, 1930), pp. 251-255.) [63.60432; 63.631 : 043.]

The Invention of a New Wood Feed Product in Germany. (Jour. Farm Econ., XII, 2 (April, 1930), pp. 340-342.) [63.60432.]

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NOTES FOR THE MONTH

National Rat Week, 1930

NATIONAL Rat Week has been fixed this year for the week commencing Monday, November 3, and the Ministry has again addressed a circular letter to all the local authorities who exercise powers and duties under the Rats and Mice (Destruction) Act, 1919, impressing upon them the desirability of making a special effort during that week to secure concerted action for the destruction of the pests.

It is generally recognized throughout the country that the depredations of rats cause immense loss, both directly in the destruction and contamination of foodstuffs and material and indirectly as agents and carriers of disease; and although many local authorities do their utmost throughout the year to carry out the provisions of the Act, there are some who do not appear to be sufficiently alive to the gravity of the subject. It is of the utmost importance that systematic action should be taken by all occupiers of land and buildings, and by local authorities and those who control large farms, estates, factories, industrial premises, etc.

A number of suggestions for concerted action and methods of procedure, specially suitable for application under various conditions, are contained in the Ministry's circular letter; and in view of the considerable interest taken in the Ministry's Rat Repression stand at the recent Fourth World's Poultry Congress at the Crystal Palace, London, local authorities have been asked to pay particular attention to poultry farms and their surroundings. In order to assist in the campaign, the Ministry has offered to lend to local authorities copies of its cinematograph film, entitled "The Rat Menace"; some of the copies have recently been revised in order to make the film more suitable for exhibition in rural areas. A set of lantern slides, together with a suitable accompanying lecture, can also be borrowed for this purpose. Copies of a pamphlet, giving the names of firms prepared to supply rat destruction preparations and materials, have been supplied

to local authorities. This pamphlet, which also contains some simple suggestions for rat destruction, is suitable for distribution to the general public, and the Ministry has suggested to authorities that copies of the pamphlet should be made for that purpose. Useful suggestions and advice are also contained in the Ministry's Leaflet, No. 244, on the destruction of rats, single copies of which are supplied free of charge on application, whilst quantities can be obtained at the rate of 6d. per dozen.

A more comprehensive publication, *Rats and How to Exterminate Them* (Miscellaneous Publication No. 51), may also be obtained from the Ministry at the price of 3d., post free. This publication of 18 pages contains nine illustrations.

The Ministry is always prepared to give assistance and advice in any cases of rat infestation which present features of unusual difficulty.

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Report of the Land Division, 1929

THE Annual Report of the work of the Land Division of the Ministry for the year 1929 has recently been published. The section of the Report dealing with small holdings reviews, generally, the operations of county councils in England and Wales during the three years since the passing of the Small Holdings and Allotments Act, 1926. The causes of the slow progress in providing additional holdings are briefly discussed, and reasons advanced for the adoption by councils of a more active policy. Statements are included showing the applications for holdings received and the number of holdings provided by each council during the year 1929, together with a table giving the total area held by each council for the purpose of small holdings at December 31, 1929.

Under the heading of "Allotments," the Report summarizes the returns received from allotment authorities at December 31, 1929, and includes statements of the total number and acreage of allotments provided in the areas of each of the different classes of allotment authority. Other matters discussed are the provision of land for allotments in Town Planning Schemes and the effect on the demand for allotments of the provision of comparatively large gardens with houses erected under the Housing Acts.

Under the provisions of the Small Holding Colonies Acts, 1916 and 1918, and the Sailors and Soldiers (Gifts for Land

Settlement) Act, 1916, the Ministry administers six estates with a total area of nearly 11,000 acres. Most of the estates are divided into small holdings and allotments, but 2,200 acres on one estate are cultivated as a profit-sharing farm. The Report gives financial statements for each scheme and describes briefly the position and progress of the settlers on each estate during the 1929 cropping season.

The Improvement of Land Acts empower landowners, with the approval of the Ministry and subject to certain conditions, to borrow money for the purpose of effecting authorized improvements of land on the security of a rent-charge which takes priority over most other charges on the estate. A brief account is given of the operations of the Ministry under the Acts during the year 1929, and a table is appended showing for each year since 1912 the total amount charged on estates in England and Wales during the year in respect of each of the principal types of improvement authorized by the Acts.

Further sections of the Report record proceedings through the Ministry, under the Property Acts, 1922 and 1924, in connexion with the extinguishment of manorial incidents, and under the Law of Property Act, 1925, and the Landlord and Tenant Act, 1927, with the apportionment and redemption of rents.

The Report also enumerates the various schemes for the regulation of commons approved by the Ministry during the year, and specifies the areas of common land and open spaces enclosed for special purposes with the consent of the Minister. Particulars are given of deeds of declaration deposited with the Ministry under the Law of Property Act, 1925, for the purpose of conferring upon the public rights of access to certain commons for air and exercise, and of the orders issued by the Ministry imposing limitations and conditions as to the exercise of such rights. The total area of commons affected by the deposit of deeds under this Act up to the end of 1929 was 9,467 acres.

The quinquennial reports made to the Ministry in 1929 by trustees of recreation grounds allotted under Inclosure Awards are briefly reviewed, and the Ministry's action thereon indicated.

The Report also gives details of the transactions effected with the Ministry's approval under the Glebe Lands Act, 1888, and the Universities and College Estates Acts, 1858 to 1925, and some account is given of the more interesting changes effected during the year in the nature of properties held by

the universities and colleges concerned, and of their investments.

A section of the Report dealing with transactions under the Tithe Acts, 1836 to 1925, includes an estimate of the amount of tithe rentcharge now existing and in the hands of the various classes of titheowners, together with details of the number of redemptions, mergers, altered apportionments, etc., of tithe rentcharge and other similar charges effected under the Acts.

Among other contents of the Report are statistical details of the work undertaken by the Ministry under Acts affecting agricultural holdings since 1921; a section dealing with the destruction of rats and mice and the measures taken during "National Rat Week"; particulars of the schemes which the Ministry has been authorized to assist financially in connexion with field drainage, water supply, and the claying of fen lands; and a note on the constitution of county agricultural committees established in pursuance of the Ministry of Agriculture and Fisheries Act, 1919, and on the activities of these committees under the Rent Restrictions Acts in connexion with agricultural cottages, and in relation to the destruction of injurious weeds.

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Devon Travelling Poultry School

THE Travelling Poultry School is a feature in the Agricultural Education programme of Devonshire that deserves wider notice. It was started many years ago to provide education in poultry-keeping for the remote parts of the county; and such has been its success that it was found necessary this year to appoint a whole-time instructress for the work. The School travels to a number of centres each year, and at each centre a thirty-hour course, extending over three weeks, is given. Conditions and circumstances naturally vary at the different centres, but the scheme of education is, broadly, the same in all cases. At each centre, fifteen pupils, on the average, are taken, and they are drawn from a zone, roughly, within two to three miles of the centre.

The School provides a hatching and rearing plant in miniature, lectures and demonstrations being given throughout the course; but pupils are expected, after the first few days, to take part under supervision in the routine work. Material for a course is provided by the purchase of eggs and day-old chicks from station holders under the County Approved Poultry Breeding Scheme. At the end of the three weeks, the

stock that has been reared is sold locally; and it is a tribute both to the quality of the stock and to the management that rearing losses are kept within a low figure. Last year it was under 2 per cent. With the aid of a cramming machine of the ordinary Sussex type, instruction in the fattening and marketing of poultry is also given, and each pupil is expected to pluck, press, draw and truss three birds. During a course, visits are paid to one or more well-known poultry farms within reasonable distance; and these excursions, which give many of the pupils their first idea of poultry farming as a commercial undertaking, are much appreciated.

At the end of a course, the sole expense of which to the pupil is an entrance fee of 2s. 6d., there is a written and practical examination, prizes and certificates being awarded to pupils showing proficiency.

The School has undoubtedly proved of distinct educational value in Devonshire. As a tangible instance may be cited the case of a general farmer who had not realized the possibilities of poultry farming until he became greatly interested in a course that was being held in his neighbourhood. As a consequence, he extended both his stock and his plant, and, in this year's County Laying Trials, entered a pen of White Wyandottes which, at the end of the first half-year, averaged 135 eggs per bird.

Further information about the School may be obtained by those interested on application to the Agricultural Organizer for Devon, 1, Richmond Road, Exeter.

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Guide to Current Official Statistics

THE value of official statistics seems to require no emphasis at a time when so many matters of paramount importance are equally conspicuous in the public interest. Reliable information upon such vital topics as the position of trade and agriculture, the incidence and trend of unemployment, the state of the public health, and the development of methods of transport by land, sea and air is essential to the ordinary member of the community no less than to the man or woman engaged in the organization of national or local activities.

Equally necessary is the provision of a handy and inexpensive means to enable the inquirer to discover which of the many Government publications issued year by year furnishes the statistics required for his particular purpose.

Such a means is provided by the Guide to Current Official Statistics, which consists not only of an annual catalogue of official publications containing statistics, but also of a detailed index to their contents, arranged under subject headings in such a manner that the nature of the information available on any topic can be ascertained with ease and celerity.

Volume Eight of the Guide (price 1s. net, post free 1s. 5d., pp. 316) has just been issued and may be obtained direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or through any bookseller.

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Effect of Basic Slag on Rush Growth

THE following note has been communicated by Mr. H. Cecil Pawson, Lecturer in Agriculture, Armstrong College, Newcastle-upon-Tyne :—In recent years, one of the chief features of interest to visitors inspecting the grassland trials at Cockle Park is the effect of slag treatment on the growth of rushes. The two plots shown in the photograph do not possess any artificial form of drainage. Both received a heavy dressing of basic slag in 1903, but since that year the plot on the left has not received any further dressing of phosphates, whilst that on the right of the dividing fence has received slag once every three years. Cake is fed to the cattle and sheep grazing on the left-hand plot during the experimental grazing period each season. As a result, through lack of phosphates, and continuous nitrogen treatment arising from the cake feeding, the herbage on this plot has become poor in feeding value ; the stocking of the plot has had to be considerably reduced in consequence, and the top of the riggs presents a matted, harsh condition. Examination of the soil after heavy rain shows that the water has scarcely penetrated the top of the riggs, but is largely shed off and, hence, tends to accumulate in the furrows. In the furrows, rushes grow vigorously, being tolerant of wet conditions. The striking observation is that the rush growth ceases at the dividing fence, for where the slag treatment has been pursued no rushes are to be found in the furrows, although no pipe or mole draining of any kind has been carried out on either plot. There are, no doubt, several causes contributing to this effect. The large and even development of clover, which is maintained in vigorous condition on the slagged plot, gives rise to better quality herbage ; thus this area is much more closely and evenly grazed, which fact, in turn, tends to retard rush growth. The natural drainage is also greatly im-

View of two grassland plots at Cockle Park. That on the left has received no basic slag since 1903 ; while that on the right, after the dressing in 1903, has received a slag dressing once every three years.

EFFECT OF BASIC SLAG ON RUSH GROWTH.

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proved by the mass of fibrous clover root opening up the soil; this is evidenced by the fact that the rain water gets down into the soil on the riggs as well as in the furrows, hence there is little accumulation in the latter, the rainfall being more evenly distributed over the total area. Further, the denser growth of herbage on the slag-manured plot which, after grazing, soon makes further growth, must result in greater evaporation of moisture from the leaf surface as compared with the no-slag plot, where the herbage is much more scanty and, once grazed, makes little further growth that season.

Artificial drainage in some form is necessary on wet clay land if sound wintering conditions for stock are desired. The lesson of this ocular demonstration, however, is that, where drainage may not be practicable for the present at least, much can be done to improve the grazing conditions by judicious manurial treatment backed up by adequate stocking. It is noticeable that the best development of clover from phosphate treatment on unimproved land is always secured when there is plenty of moisture present, and, as demonstrated in this instance, the development of a healthy, vigorous clover plant assists in dealing with the problem of excess moisture in the soil.

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Rations for In-Pig Sows

THE following note, supplementary to one published in the August, 1930, issue of this JOURNAL (p. 417), has been communicated by Mr. V. C. Fishwick, P.A.S.I., N.D.A., N.D.D., South-Eastern Agricultural College, Wye :—

Many breeders are feeding to their in-pig sows rations which contain 10 per cent. of fish meal or other protein supplement. It was stated in the JOURNAL for August that during the past winter satisfactory results had been obtained in the College experimental herd with a ration in which the fish meal was reduced to 5 per cent. During the past summer, in the case of sows which had a free range at grass, it has been found possible to omit the fish meal or other protein supplement altogether for the first three months of the gestation period. Normal healthy pigs of average weight at birth have been produced by large black sows run on grass, which have received from weaning to within three weeks of farrowing 3 lb. per head per day of a mixture of 45 per cent. barley meal, 10 per cent. maize germ meal, and 45 per cent. sharps, with 1½ lb. of chalk and ½ lb. of salt added to each 100 lb. of meal. The ration given during the last three

weeks before farrowing was 40 per cent. barley meal, 10 per cent. maize germ meal, 45 per cent. sharps, and 5 per cent. fish meal, with 1½ lb. of chalk and ½ lb. of salt added to each 100 lb. of meal.

Apart from the fact that an excess of protein in the ration of in-pig sows is undesirable it may be pointed out that by reducing the fish meal from 10 to 5 per cent. during the winter months and omitting it altogether during the summer a saving of 10s. per sow per annum is effected.

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Report of the Official Seed Testing Station

THE 11th Annual Report of the Official Seed Testing Station for England and Wales, covering the period from August, 1927, to July, 1928, appears in No. 3, Vol. II, of the Journal of the National Institute of Agricultural Botany, copies of which may be obtained from the Institute, Huntingdon Road, Cambridge, price 2s. 6d. each, or post free 2s. 9d.

During the period under review, the total number of samples received for analysis reached 26,583, a figure exceeding the total of any previous season and equivalent to an average of approximately 511 samples per week, or of 85 per working day. The source of the samples, together with comparative figures for the previous seasons, are as follows :—

	1927-28	1926-27	1925-26
Seed firms :			
Number sending samples	1,759	1,610	1,732
Number of samples received	20,473	17,673	18,375
Farmers, etc. :			
Number sending samples	871	701	676
Number of samples received	1,905	1,374	1,404
Public Departments :			
Number of samples received	4,205	3,790	3,105
Total number of samples	26,583	22,837	22,884

The 1927-28 figures show an all-round increase: 9 per cent. in the case of seed firms sending samples, 15 per cent. in the number received from seed firms, whilst a 24 per cent. increase is shown in the number of farmers using the Station, and 38 per cent. in the samples sent by them. An analysis of the samples shows the following distribution according to the related species compared with similar figures for the previous seasons :—

	1927-28	1926-27	1925-26
Cereals	10,616	8,228	8,402
Pulses	2,452	1,975	2,601
Roots and vegetables	5,781	5,182	4,954
Clovers	4,578	4,727	4,280
Grasses	3,034	2,508	2,418

The number of cereal samples shows an increase of 29 per cent. over the previous season's figures; pulses an increase of 24 per cent.; grasses 21 per cent.; and root and vegetable seed samples 11·5 per cent. Clover samples, on the other hand, show a decrease of 3·1 per cent.

The particulars of samples received each month follow in general outline the average of the nine previous seasons, and were as follows :—

	1927-28		1927-28
August	379	February	5,135
September	1,272	March	5,613
October	3,352	April	2,217
November	2,342	May	808
December	1,840	June	296
January..	3,167	July	162

Cereals.—The average percentage germination of cereals shows a falling off when compared with the previous season's figures. The average germination of wheat (93·9 per cent.) was, in fact, lower than in any previous season with the exception of 1924-25. The average for barley was 94·1 per cent., oats 92·9 per cent. and rye 89·9 per cent.; 9·6 per cent. of the wheat samples and 10·9 per cent. of the barley samples gave germination results below the authorized minimum.

A naked eye examination showed that 7·3 per cent. of the wheat samples were infected with Bunt and 3·7 per cent. with Earcockle. Ergot was found in 1 per cent. of wheat and 37.8 per cent. of the rye, and Smut in 10 per cent. of the barley samples. The percentage of samples of rye infected with Ergot was greater than in any previous season recorded. It should be noted, however, that the quantity of Ergot found in the majority of samples of both wheat and oats was small.

A table is included in the Report showing the distribution of cereal samples received for test arranged according to variety. Red Standard again heads the list of the wheats, Plumage Archer of the barleys, and Victory of the oats.

Pulses and Root and Vegetable Crop Seeds.—The average germination of the pea samples (85·9 per cent.) was identical with that of previous seasons. Field and broad beans were below the average, but runners showed an improvement (82·4 per cent.) when compared with the average of the previous seasons. The averages of the turnip and mangold samples were slightly below the average for 1917-1927, but there was an improvement in the swedes. With the exception of onion (61·7 per cent. as compared with an average of 66·8 per cent.) improvement was shown in the average germination of all the garden seeds.

Grasses.—The average purity of grasses showed a slight improvement over the previous season, but was still below the average of the six previous seasons. The average purity of Italian ryegrass samples was lower than in any of the previous six seasons, and the percentage of samples containing 1 per cent. or more of injurious weed seeds was greater than in either of the two previous seasons. The germination of Cocksfoot (88·2 per cent.) was almost the lowest for the past six seasons, but the purity was a little higher than the average. Timothy showed an improvement both as regards purity and germination.

Clovers.—The average purity of all samples of Red clover was almost the lowest yet recorded, and the germination (70·6 per cent.) was lower than in any season since 1917-18. White clover gave an average purity rather below the average of the previous seasons and there was a marked falling off in the average germination (69·1 per cent.). Wild white clover gave an average germination of 63·7 per cent., as compared with an average of 74·5 per cent. in the seasons 1917-1927, an average of 7·6 per cent. of hard seeds as compared with 12·9 per cent., and an average of impurities of 10 per cent. as compared with 9·38 per cent.

The percentage of samples of English Red clover containing Dodder (3·4 per cent.) was slightly lower than in the previous season (3·6 per cent.). 13·9 per cent. of the French and 86·6 per cent. of the Chilean Red clover were found to contain this weed.

Investigations.—In addition to the normal tests, particulars of which are given at the beginning of this note, some 3,410 tests of an investigational nature were carried out at the Station during the course of the season. Laboratory and field studies have also been carried out in connexion with Wild White clover, abnormal and defective growths of Brassicas, seed-borne diseases, and provenance studies of Red and White clover.

The Report also includes a copy of the papers set in the examination in the principles and practice of seed testing which was held at the Station in July, 1928.

* * * * *

The Control of Moles

THE following note has been communicated by the Department of Agriculture and Horticulture of the University of Bristol. Complaints having been received concerning damage done by moles to permanent pastures, drainage embankments, etc., the Department arranged to ascertain the value of certain materials, known to be effective

rodent controls, for the purpose of ridding badly infested areas of moles where the use of other poisonous substances is undesirable or impracticable.

By the courtesy of Mr. H. B. Napier an area of mole-infested land in Ashton Park (near Bristol) was placed at the disposal of the investigators* and the experiments described below were commenced during March, 1928.

A trench 1 yd. wide and 1 ft. 6 in. deep (*i.e.*, down to the mountain-limestone rock) was dug all round the area, enclosing approximately 2,500 square yards. Fine mesh wire netting was erected in the inside of the trench and turned into the soil so as to prevent the moles from leaving or re-entering the area. The wire netting extended above the ground to a height of 2 ft. 6 in. The whole area was further enclosed by means of a barbed-wire fence to keep off sheep and deer.

Baits prepared from Red Squill (*Urginea maritima*) were put down in this area on April 3, 1928. One hundred and ninety grammes of earthworms were treated with a mixture of equal parts of fine flour and red squill powder weighing 42½ grammes, so that each bait contained approximately 10 parts per hundred of red squill powder. The object of using flour was to enable the squill powder to adhere better to the worms.

At the same time 150 baits consisting of shredded meat which had previously been soaked for twenty-four hours in liquid red squill were prepared. These were made from 250 grammes of meal, 210 grammes of shredded meat, together with 212·5 grammes of liquid red squill giving a total weight of 672·5 grammes of material. This material was divided into 150 baits, an average weight of 4½ grammes per bait, which gave an equivalent of 10 parts per hundred of red squill powder.

Immediately following manufacture, the baits were inserted into the runs by the following methods: Two baits were placed in each hole, a ticket indicating the nature of the bait used being placed near the point of insertion. In all, 237 baits were inserted in this way.

After a period of 14 days the baits were inspected in order to count the number that had been taken. Of the 143 meal and meat baits, 95 were taken by moles, and, of the 94 worm baits, 59 were taken; that is about 65 per cent. of baits laid were taken by moles.

All the hillocks were counted at the time of baiting, and it was found that there were 295 on the enclosure. These were then levelled down in order to ascertain whether fresh workings occurred in the circumscribed area.

*Messrs. A. W. Ling and C. A. MacEacharn (Bristol University) with Mr. E. C. Read (Ministry of Agriculture).

On the following dates fresh molehills were levelled down :—April 24, 75 ; April 25, 10 ; May 8, 59 ; June 1, 6 ; June 15, 9 ; September 12, 3 ; December 17, 0.

On January 12, 1929, the wire netting was lifted to allow moles access to the experimental area, but on this date and on further inspections on January 17 and September 6, 1929, no fresh workings had occurred, and since the middle of September, 1928, there have been no further workings. At this time, there was a certain amount of activity on the part of the moles in the area surrounding the plot, and therefore a few traps of the usual type were inserted around the plot. This proved to be quite satisfactory, as several moles were caught in these traps. After the wire netting was removed from one side of the plot on January 12, 1929, moles which were working freely outside the experimental plot did not penetrate into this area, and up to January, 1930, there was no evidence of re-infestation except at the top end of the area close to a water reservoir where a mole had burrowed underneath the wire netting and had continued its activities along one of the old runs. This mole was subsequently trapped. Baiting with red squill would appear to have proved satisfactory, although it must be pointed out that the drought of the year 1929 probably prevented the moles from becoming very active on the plot. At one period, just after the lifting of the wire, there was evidence that one or more moles had gained access to the enclosed area, as runs appeared following the lines of the old workings which had been in use before the experiments started.

Before the wire was lifted, every visible mole run in the area was carefully dug out by means of long-handled spades and trowels, but no dead mole was found in any part of the run, and it is presumed that the action of red squill on moles is the same as that on rats, *i.e.*, that it drives them somewhere in search of water, and presumably the moles left the surface runs and went much deeper.

At the same time as the experiments with baits described above were carried out (*i.e.*, in April, 1928), two areas (one of which was very damp), measuring 950 sq. yd. and 1,500 sq. yd. respectively, were gassed without the sites being subjected to any form of preparation. The gases employed were on one plot Cyanogas (calcium cyanide) and on the other Horo (compound of sulphur and other substances). Whilst the first treatment with Cyanogas was not satisfactory, a further gassing of the plot in November, 1928, when 178 molehills were levelled down, proved successful, and on December 17,

1928, no more molehills were found on the gassed site, while, in a very narrow strip surrounding this area, 167 new hills were counted. Similar results were obtained with Horo gas. It appeared evident that some of the moles had retreated from the gassed areas.

Conclusions.—From the foregoing experiments, it would appear that baits prepared from red squill, either as a liquid or powder, are satisfactory for ridding badly-infested areas of moles ; but it must be pointed out that these baits must be prepared with considerable care, particularly as regards handling, and also that they must be inserted into the run with the minimum amount of disturbance of the run. It was found, by a smaller experiment, that where a run was very much disturbed, or where the naked hand had rubbed on the soil of the burrow, the mole escaped from the run just near to this point by means of a small run made to the surface. It appears also that gassing will drive the moles from the runs ; but, for satisfactory results, it is obviously necessary to carry out this work when the moles are actually in the runs, otherwise the gas leaves a solid deposit in the runs, and although the actual area does not become re-infested, some of the moles carry on their activities around the treated area.

In gassing mole-infested areas, it is necessary that the retreats of the moles under banks or in woods should be gassed as well as the actual outside runs.

Trapping, with all its limitations, is quite satisfactory in the hands of an experienced person. On large estates, or where there is sufficient work to justify the employment of a professional mole catcher, trapping is recommended.

The investigators' thanks are due to the Ministry of Agriculture and Fisheries for a grant in aid of this work ; to H. B. Napier, Esq., J.P., for allowing the investigation to be conducted in Ashton Park ; and also to colleagues who assisted in certain sections of the field work.

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Coloured Diagrams of Some Pests and Diseases of Fruit Trees

THE Ministry still has available copies of coloured diagrams of four common pests and diseases of fruit trees, etc., these showing 1, the Apple Blossom Weevil ; 2, Winter Moths ; 3, Apple and Pear Scab ; and 4, Silver Leaf. The diagrams, in size 30 in. by 20 in., are finely produced by the four-colour process, and are not only technically clear and accurate but artistically attractive. Suitable for display on walls, they afford an

easy means of identifying the characteristic damage caused by the respective insect and fungus pests, and should be very helpful to fruit growers, allotment societies, local educational authorities for use in rural schools, and for lecturing purposes. The diagrams are supplied in sets of four, and can be obtained, price 9s. unmounted or 15s. mounted on rollers, post free, on application to the Ministry, 10 Whitehall, London, S.W. 1.

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New Series of Bulletins and Leaflets

THE Ministry has for some time had under consideration the form in which its leaflets and priced publications are issued. It has now been arranged that the existing Leaflets, Miscellaneous Publications, Research Monographs and Sectional Volumes of Leaflets shall be gradually replaced by two new series of publications, viz.: "Advisory Leaflets" and priced "Bulletins."

Advisory Leaflets will consist of brief, simply-written statements on the subjects treated. As existing leaflets come up for revision they may be withdrawn, or be re-issued as Advisory Leaflets, and/or, if the subject warrants it, be extended into Bulletins.

Subject to certain safeguards for the avoidance of waste, the restrictions hitherto imposed on free distribution will be modified as regards Advisory Leaflets (and leaflets at present in being). Full particulars will be found in the revised list of the Ministry's Publications, a copy of which can be obtained free on application.

The *Bulletins* will replace the existing series of Sectional Volumes, Miscellaneous Publications and Research Monographs, and will not only deal with new subjects but will in time cover such of the existing leaflets as require fuller treatment than is possible in leaflets intended for advisory purposes. As part of the new scheme, it is intended also to improve the whole standard of production, by means of better type and paper, improved covers, and, in some cases, by the introduction of coloured plates. The majority of the volumes will be illustrated.

The following *Bulletins* are now available and may be obtained, post free, at the prices mentioned :—

*1. *Some Diseases of Farm Animals.*—Illustrated. Price 1s. 6d.

*3. *The Improvement of Grassland.*—Price 8d.

4. *Fruit Production: Soft Fruits and Nuts.*—Illustrated. Price 1s.

*5. *Commercial Fruit Tree Spraying and what it Costs.*—Illustrated. Price 6d.

*6. *Diseases of Poultry.*—Illustrated. Price 8d.

7. *The Scientific Principles of Poultry Feeding.*—By E. T. Halnan, of the School of Agriculture, Cambridge. Price 8d.

8. *Poultry Keeping on the General Farm.*—Illustrated. Price 8d.

*12. *The Culture of Fish in Ponds* (2nd edition).—A summary of successful methods employed in fish farming countries. Price 4d.

*16. *Variations in the Composition of Milk.*—An authoritative summary of the causes. Price 4d.

17. *County Egg Laying Trials in England.*—Price 1s. 6d.

18. *Table Poultry Production.*—A report on the experiments conducted under the National Poultry Institute Scheme at the S.E. Agricultural College, Wye, Kent. Illustrated. Price 1s. 6d.

19. *Poultry Breeding for Egg Production: The Effects of In-Breeding.*—A report on the experiments conducted under the National Poultry Institute Scheme at the Cheshire School of Agriculture, Reaseheath. Price 6d.

The publications, the titles of which are indicated by an asterisk, have already appeared in a different form, but are now re-issued in improved or revised editions in the new series.

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Broadcasting Agricultural Market Information

FOR a considerable time past the Ministry has been able, by arrangement with the British Broadcasting Corporation, to broadcast a weekly bulletin of market prices each Thursday between 6.35 and 6.40 p.m. from most of the regional and relay stations; and, more recently, to broadcast from Daventry after 9 p.m. each evening (except Thursday and Sunday) the fat stock prices at certain selected markets.

With the object of simplifying its programmes, however, the Corporation has decided, as from Monday, October 6, to transmit the bulletins at the same time each evening and from all stations. From that date the daily bulletins of Fat Stock Prices will be broadcast from all stations at approximately 6.38 p.m., that is, immediately after the London Stock Exchange Report on Mondays, Tuesdays, Wednesdays and

Fridays, and immediately after the First General News Bulletin on Saturdays. The Thursday evening bulletin of Market Prices for Farmers will continue to be broadcast as at present, between 6.35 and 6.40 p.m., but the London bulletin which is now relayed by Belfast and Plymouth will in future be broadcast also from the London and Midland Regional transmitters.

The net effect of these changes is that farmers will be able to hear the Fat Stock Prices each evening at about 6.38 p.m. either from their Regional transmitter or from Daventry.

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Demonstrations of Horticultural Machinery

THE demonstrations of horticultural machinery, carried out by the Ministry in collaboration with County Authorities, in the spring of 1929, and again in April and May of this year, attracted widespread attention in the areas surrounding the centres at which the demonstrations took place. It is evident that an increasing interest is being taken in tractors and implements adapted for work in orchards, and the Ministry proposes to arrange a further series of demonstrations to take place in the spring of 1931.

It has already been pointed out in this JOURNAL (October, 1929, p. 606) that cultivation machinery for use in orchards is subject to certain limitations which do not apply in the case of machinery used in open field work. This fact is appreciated by manufacturers, and it is satisfactory to be able to record that the tractors and implements demonstrated in the spring of this year were in many cases better adapted for the work in view than those used in the demonstrations of 1929. There still appears, however, to be scope for adaptations and new construction, and it is to be expected that the power units and implements demonstrated next spring will show further improvements in design.

Much has been learnt from the demonstrations that have already taken place, but nothing of greater importance than the need for adequate power in the tractors used. Low-powered machines and small implements have their sphere of usefulness in horticultural work, but no one would claim that they should be used for the principal cultivation operations in the larger orchards.

It cannot be too firmly emphasized that for these operations a tractor of similar power to that required for open field work is a necessity.

SOIL SURVEYS AND THEIR UTILIZATION

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FOR some years past, many countries of the world have engaged in the making of soil surveys. Various methods have been suggested and tried, and numerous reports published. Of special interest is the work in the United States which, for the past thirty years, has proceeded without interruption under the guidance of the Bureau of Soils and, later, of the Bureau of Chemistry and Soils of the United States Department of Agriculture, in co-operation with the various States. This work has been very extensive and has covered all parts of the Union. It has also embraced the surveying of a great variety of agricultural, climatic, and soil conditions, so that it might well be considered an outstanding example of the successful application of soil surveys to the classification of the soils of a nation. There are no available data regarding the extent of the soil surveys completed to date within the United States, but, up to and including the year 1912, the survey of over 333,000,000 acres had been completed. It is impossible to say what acreage has been added during the past seventeen years, but it is quite possible that the present surveys would show published work concerning well over 600,000,000 acres.

A soil survey may be defined as the identification, classification, and mapping of the various soils of any given district. It should embody fundamentally a detailed study of their present and possible future utilization—the methods of cultivation and fertilization now in use on the various soil types, and suggestions for their improvement. Such important factors as crop adaptations and systems of farming as applied to the different soils also receive careful consideration. The soils recognized are then classified and their occurrence and distribution accurately recorded on a map. The completed soil survey with the accompanying report and map represents a complete inventory of the soils of the particular district, together with many important facts concerning their cultivation, treatment and utilization.

In America, soil surveys have been more extensively made and utilized than anywhere else in the world. It may be of interest, therefore, to describe briefly the American system of soil classification, which has worked very satisfactorily in the United States, and to refer to some of the field methods, and to the value of the work to varied agricultural interests.

The American Method of Soil Classification.—The most important principle of the American system of classification is that it is an economic one, and that soils are defined and classified on the basis of the *characteristics of the soils themselves*, rather than in their relationship to other factors, such as geology, climate, natural vegetation or crops. The unit of classification is the "Soil Type," which is a combination of a "Series Name" and a "Class (Texture) Name" as, for example, "Sassafras Loam" in which "Sassafras" indicates the "Series Name" and "Loam" the "class (texture) name," the two names together representing "the soil type."

The Soil Series.—The determination of the Soil Series is based upon the following soil characteristics :—

I. Geological Origin of Soil Material.
II. Mode of Formation.
III. Topographical Position.
IV. Drainage.
V. Profile.

The Soil Class (Texture).—In the United States it is recognized that all soils are made up of the following soil separates :—

Fine Gravel	2 to 1	mm.
Coarse Sand	1 to 0·5	,,
Medium Sand	0·5 to 0·2	,,
Fine Sand	0·2 to 0·1	,,
Very Fine Sand	0·1 to 0·05	,,
Silt	0·05 to 0.005	,,
Clay	0·005 to 0	,,

together with more or less organic matter.

The content of organic matter in soils, except in rare cases, is small, seldom amounting to more than 10 per cent. in agricultural soils and usually much less. Furthermore, if thoroughly decomposed, as in the average soil, it is extremely fine in grain and falls within the clay group of the soil separates. It is evident, therefore, that the texture of most soils depends mainly upon their mineral composition. It is further evident that the heaviness or lightness (texture) of any soil depends upon the relative proportion of the various soil separates of which that soil is composed. Experience has shown that a great range of combinations exists and therefore twenty textural groups are recognized. These groups are as follows :—

(1) Coarse Sand.
(2) Sand.
(3) Fine Sand.
(4) Very Fine Sand.
(5) Loamy Coarse Sand.
(6) Loamy Sand.
(7) Loamy Fine Sand.
(8) Loamy Very Fine Sand.
(9) Coarse Sandy Loam.
(10) Sandy Loam.
(11) Fine Sandy Loam.
(12) Very Fine Sandy Loam.
(13) Loam.
(14) Silt Loam.
(15) Sandy Clay Loam.
(16) Clay Loam.

(17) Silty Clay Loam.
(18) Sandy Clay.
(19) Clay.
(20) Silty Clay.

If gravel, stones or shale be present in such quantities as to influence the economic value of the soil type the terms "gravelly," "stony" or "shale" are used in addition to the class name.

In the actual determination of the soil class (texture) in the field only the surface layer (6 in. to 12 in.) receives consideration and the class of the soil type is named accordingly. The other characteristics of the particular soil type under observation are also examined in the field and the type is classified in a definite "Soil Series" according to these characteristics. The series name, together with the class name, designates the "Soil Type."

Making the Soil Map.—In the actual soil mapping in the United States, the field men available in a given area are divided into field parties, two or more men working together in each party. Three men often work together to advantage. Automobiles equipped with special speedometers for the measuring of short distances are used for transportation. The usual procedure is to choose each day a circuit for survey surrounded by roads or lanes, one man remaining with the car and surveying the soils along the roads, the other men walking through the fields also identifying and mapping the soils and joining the car at a previously appointed place. The soil boundaries mapped by the various men are then discussed and joined. Each man is of course equipped with a base map upon which the soil boundaries are placed, or, having no base map, constructs his own with the assistance of a plane table. One man, usually the one having the greatest experience, is placed in charge of all the parties and is responsible for the planning and conduct of all the field work. At the completion of the survey, he is also charged with the preparation, for publication, of the report of the area.

How Soil Types are Determined.—The soil surveyor's tools are a soil auger about 3½ to 4 ft. in length capable of extension 2 or 3 ft. deeper if necessary, a spade and a hand trowel. In ordinary soil surveys, the auger is the implement most used. With this instrument, the surveyor determines the texture of the surface soil and establishes the class of the soil type under examination, together with the other various characteristics of the whole soil section to a depth of 3 ft. or more. He therefore examines the whole of the soil profile with the soil auger. The number of examinations necessary depends

entirely upon the amount of detail encountered in the field, but in no case in detailed mapping are examinations made at a greater distance than a quarter of a mile apart. When all the soils of the selected area are identified and mapped, the report of the area is written.

The Soil Survey Report.—The soil survey report aims to give a very brief description of the area under survey, such as its location, boundaries, size, the general physiography, topography and the drainage of the region. Brief statements are made concerning the character and density of the population; principal towns; transportation facilities by rail, road or water; markets; and climate. The distribution and amount of rainfall; extremes of heat and cold; frosts; and the length of the growing and grazing season are given; and the influence of these climatic factors on the agriculture of the region is stated. Considerable information concerning the present agriculture of the area is also included, such as the history of crops and soil usage, the present status of agriculture, with particulars of the main money crops and principal subsistence crops. Census figures are quoted showing the extent, yield and value of the different crops produced and the number and value of live stock. The adaptations of various crops to the soils of the region are mentioned, together with such facts as methods of cultivation; farm equipment used in the area; rotations practised; fertilizer treatments to pastures and the various crops; the kind, efficiency, wage and abundance of labour available; the average size of farms; and the tenure and money value of land. This information aims to furnish the reader with a clear idea of the general nature of the various agricultural conditions existing within the region.

Most of the report, however, is given to a detailed discussion of the soils, each soil type is named, its colour, depth, texture and profile described, together with a detailed description of the location, topography, drainage, agricultural importance and nature of use, *i.e.*, whether as arable land, permanent or temporary pasture or for forestry. The relative importance of crops grown on each soil type; the average and range of crop yields obtained; how the cultivation of each particular soil type is handled; the kind and amount of fertilizer used on crops; the cash value of each soil type; and such suggestions concerning the improvement of cultural practices as comparative observations may dictate—all these points are also related in detail for each individual soil type.

The completed report therefore furnishes a considerable fund of agricultural and soil information of great value to both practical and scientific interests, and it is the aim of this paper to attempt to point out the value of such soil surveys and to indicate how soil survey reports may be best utilized by all those interested in the various agricultural pursuits.

Value of Soil Surveys to Institutions of Research.—Soil surveys are of inestimable value to agricultural research institutions and especially to those engaged in the solution of crop production and other problems of the soil, from whom advisory information upon these subjects may be expected. Usually, in England and elsewhere, such institutions are charged with the duty of supplying this information in some specific district, such as two or three counties or a large political sub-division. In the United States, each state supports at least one, and sometimes more than one, agricultural experiment station having the same responsibility within its respective state. These institutions are, therefore, greatly interested in their own local problems of crop and soil treatment. It is also generally recognized that different soils respond differently to given crops and given treatment, and it is, therefore, very essential that the extent and identity of the soils under treatment be thoroughly understood. This information the soil survey supplies. The manifold advantage of such basic information can hardly be questioned. By such a system in experimental soil work, all experiments are located on typical soil types with the assurance that results secured are applicable to the same soil under the same climatic conditions, and that conclusions drawn are of the utmost scientific accuracy and practical value. The State Experimental Stations of the State of Iowa are so convinced of the soundness of this system that there have been established throughout the State many soil experiment fields* located upon specific representative soil types as identified and classified by soil surveys. The results from these experimental fields are giving basic comparative information for each soil type, and upon such soil problems as the use of farm manure, the application of lime, the addition of phosphorus either in the form of rock phosphate or super (acid) phosphate, the use of complete commercial fertilizers, and the turning under of crop residues. By such work, the experimental error due to soil variation is reduced to a minimum. The same principle applies in other

* Soil Experiment Fields and their Value. P. E. Brown, Iowa State College. (*Soil Science*, Vol. XIV, No. 5, November, 1922.)

lines of agricultural research in which the soil factor plays a part, and satisfactory, accurate experimental results will only be obtained by an understanding and classification of the soil types concerned. This information the soil survey supplies.

Soil Surveys and the County Organizer, Advisory Chemist and Advisory Specialist.—The task of the county organizer and advisory chemist in any agricultural community is a most difficult one, and each crop-year brings with it additional problems and responsibilities. If the fruit crop of John Smith fails to respond to a certain cultural treatment or method of disease control, or if Will Jones desires to grow a crop of sugar beets and has never before attempted the cultivation of the crop, the adviser is expected to furnish the necessary magic to bring about the desired result. Great advances in agricultural science in the past decade have enabled the adviser to give most helpful advice. In the case of the proposed sugar beet crop, he is able to tell the grower at once the name and variety of the best seed, the kind and amount of fertilizer needed, and complete information concerning the cultural practices known to be successful in the production of the crop. In fact, he has available and actually furnishes very full information upon every condition necessary for successful production except the soil and the weather. Weather conditions are, of course, beyond human control, and add just another speculative element to crop production and the interest of farming practice ; but, concerning the soil, how much more simple the problem would be were the adviser able to designate and, upon examination, point out on the grower's farm the soil best suited to the sugar beet crop, or, in the too frequent absence of a desirable soil type, advise against the proposed planting and suggest other crops which he knows are successfully grown on the soils in question.

With the many duties of the adviser, he is quite unable to make personal detailed soil studies, and for lack of a soil survey the necessary information would not be to hand. Once the soil survey is completed and published, however, a great fund of soil information is at once available, and, with a little study of the report and soil map, the adviser soon finds himself in a position to say to Will Jones that the best soil on his farm for the growing of sugar beet is the "Rexton Sandy Loam" ; further, that there are about 40 acres available, and to obtain maximum results with this soil

the crop requires about 750 pounds of commercial fertilizer to supplement the application of about 15 tons of farmyard manure. He can further advise that there are or are not other soils on the farm worthy of consideration for the production of the crop, and the programme of beet production must be regulated accordingly. Information of such a basic character cannot fail to be appreciated in any agricultural community, and it is only through the availability and utilization of soil survey reports and maps that it becomes available. The expansion of the application of such advice to the production of any crop on available soil types of a county, or even national, area is of inestimable value in the planning of present or future economic production programmes.

The Soil Survey and the Farmer.—The farmer is the ultimate consumer of all economic agricultural information, whether it concerns machinery, animals, crops or the tilling of the soil upon which all his efforts depend. He it is that all agricultural research aims, directly or indirectly, to help. To be successful, soil surveys must be of benefit to the farmer, or their existence can hardly be justified, and the expenditure of public funds in obtaining them would be entirely unwarranted. How then do soil surveys benefit the farmer, and how can he utilize them to his advantage ? This at first thought seems a difficult task for, as an individual, he is already nearly overwhelmed with his many practical problems ; and it is indeed difficult for him to find time and a place in his overcrowded mind for the new discoveries the science of agriculture has to offer. He does, however, realize that his whole well-being is to a large extent dependent upon the skill with which he cultivates and understands the responsiveness of his soil to his efforts. For years and, sometimes, even for generations, he and his ancestors, consciously or unconsciously, have been close students of the soil, and have learned by experience just when the "clay field" should be ploughed and how the best seed bed is prepared on that "sandy piece" ; that the "sandy piece" grows good sugar beet but poor wheat, while on the "clay field" the conditions are reversed. In the little sphere of his own farm, he is an expert on the utilization of his own land, but at a total loss to express himself in *soil terms* universally understood by himself and others. Here the soil survey comes to his assistance. He obtains a soil survey report of the area in which his farm is located, he refers to the soil map and

perhaps with some effort locates his land; closer observation shows him that the "clay field" really isn't "clay" at all, but Sassafras Loam, and the report also says that this soil grows excellent wheat but a poor quality of sugar beet, just as he knows it does. Reading further he finds that it also gives excellent returns with lucerne or potatoes. Immediately comes the idea—"there on my Sassafras Loam I'll put the lucerne crop I need so badly and have always been afraid to attempt." The educational work is started; *soil terms* come into use in the community; the county organizer and advisory specialist, with the use of soil survey maps and reports, are soon able to identify, name and understand the crop adaptations, cultural treatment and economic utilization of the soils of the district.

All the agricultural interests find themselves on common "soil ground," and just as heretofore they have been able to recognize, name and understand the economic value of Jersey cows, white leghorn chickens and alsike clover, they are now able by reference to soil survey maps and reports to identify, recognize and understand the economic value and crop adaptations of soil types. Scarcely more need be said of the value of such information to the individual farmer, once it finds root in the agricultural community. It should be emphasized, however, that it is difficult for the average farmer, personally, to seek and digest soil survey reports, but the duty of conveying the soil facts lies with the county organizer, advisory specialists and other agricultural agencies who must, of course, first acquaint themselves with the use of available soil survey reports and maps.

Soil Surveys and Land Utilization.—Perhaps the broadest and most useful application of the practical value of soil survey reports finds expression in the study of the utilization of lands for agriculture or other purposes. Such studies embrace the present as well as future possibilities of the land, and thus assist in the economic utilization of land already developed and indicate its potential possibilities. All agriculture is, of course, dependent upon the land available for cultivation or other purposes, and a complete understanding of its classification and utilization is essential for success. This applies to the agriculture of an individual farm, a county and even a nation.

As an example of its application to large land areas, the State of New Jersey, U.S.A., is of interest. The boundaries of New Jersey embrace an area of approximately 7,000 square

miles or 4,500,000 acres. The value of agricultural products varying from season to season is between £20,000,000 and £30,000,000. This return comes from a great variety of crops and other agricultural products. Among the crops produced (in 1925) and their approximate acreage the following deserve mention.

Less intensive crops such as maize, wheat, oats and rye occupied approximately 340,000 acres. There were about 412,000 acres of hay made up of timothy, clover and alfalfa (lucerne). Pastures took up 355,000 acres. There were over 5,000,000 fruit trees, mostly apples and peaches; nearly 2,000,000 grape vines; and a total of approximately 200,000 acres of intensive crops, such as white potatoes, sweet potatoes, tomatoes, asparagus and a great variety of other market garden crops. In addition, there were about 122,000 cows and 4,000,000 chickens. Forests occupied about 2,000,000 acres. In this State, the lands are therefore being utilized in a most diversified manner. Further, land values are high and agriculture is becoming rapidly intensified. It is highly essential, therefore, that each soil type be utilized in the most efficient and economic manner. Fortunately, a complete detailed soil survey of the whole of New Jersey is available. This, representing as it does a complete inventory of the soil resources of the State, is assisting in the solution of many agricultural problems.

An analysis of the data made available by the soil surveys shows that, in New Jersey as a whole, there are 2,511,194 acres of well-drained arable soils available, 1,091,510 acres of soils needing drainage and about 717,000 acres of soils not adapted to cultivation and therefore best utilized as permanent pasture or as forest lands. Of the arable lands, it is known and well established that certain crops and crop varieties grown in the State are better adapted to certain soil types than others. For example, the field studies of the soil survey indicate that the best soil for the production of white potatoes is the Sassafras Loam, and the State possesses a total of 184,290 acres of this soil type. The acreage of potatoes produced is now only about 70,000 acres, showing that there still remains a potential acreage of about 114,000 acres available for this crop. Should economic conditions warrant the expansion of the potato acreage, therefore, the Sassafras Loam would be the soil type strongly recommended for development. The same information is available for wheat and oats, timothy and clover, maize, rye, alfalfa, sweet

potatoes, orchard and small fruits, cranberries and vegetables —in other words, all the crops under cultivation within the State.

Of the lands needing drainage, it is estimated that approximately 200,000 acres of these soil types are of sufficient potential value to warrant the expense of immediate reclamation. The balance of all land of this type in the State, under present economic conditions, is best utilized either as permanent pasture or for forestry. With the study of such complete soil information, this State is putting into effect a sound policy: land utilization and agricultural development are being made possible only through information available in the completed soil survey.

The county organizers, advisory specialists and research workers of the agricultural college and experiment station, and the farmers of New Jersey, are being educated in the application of soil surveys so that they may all be able to identify soil types by name and understand the characteristics, utilization and value of the various soils in the State and on their own farms. This phase of the work naturally takes some time, but it is progressing rapidly and, in the near future, the county organizer and farmer will discuss the value of Sassafras Loam as compared with the Shrewsbury Sandy Loam for the production of a potato or any other crop, just as they now talk over the relative possibilities of Shorthorn and Jersey cattle for the farm herd. In short, the soil survey has enabled all those engaged in agriculture to express themselves in *soil terms*, the lack of which, hitherto, has been a serious handicap to the exchange of helpful ideas gained either by experimentation or practical experience in the cultivation of soil types.

Soil surveys already completed throughout the United States have given soil terms and soil classification a national scope; the completion of additional surveys in other countries makes for international soil understanding. Agricultural conditions of one nation constantly affect others, for present agricultural problems are world-wide; changing economic conditions constantly affect crop production; while shifting markets and increasing competition further complicate matters. As the centres of population increase, extensive methods of production give way to intensive cultivation; new irrigation projects develop and unsuccessful ones fall by the wayside; afforested areas become new arable and pasture lands; there is an over-production of agricultural products; prices fall; unprofitable marginal lands go out of production; erosion

takes its toll and further depletes them; there is a world-wide depression in agriculture; farmers become bankrupt and leave the land.

All this has taken place from time immemorial; it is taking place at the present time. "What is the solution?" we all ask, at the same time realizing the many complicated factors involved. The solution of all our agricultural problems is most difficult, and perhaps sometimes seems impossible. We may at least be sure that the sooner the soils of individual farms, counties and nations are completely surveyed, the sooner we may hope for that world-wide prosperity of agriculture to which every conscientious tiller of the soil is entitled.

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THE VARYING EFFECT OF LIME ON GRASS LAND WITH DIFFERENT SCHEMES OF MANURING

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UNDER modern methods of manuring and treatment of grass land, the question of liming assumes greater importance as time goes on. It is gradually becoming recognized that, whereas much of the grass land in this country is capable of benefiting by the application of lime, there are other areas on which lime may be harmful, reducing the crop instead of increasing it. On the other hand, it has recently become clear that under certain extreme conditions of climate, such as frost and drought, judicious applications of lime may make all the difference between a reasonable crop and none at all. Both these cases are exemplified at the present time by the Rothamsted permanent grass plots on heavy loam, and future developments will be carefully watched.

In an earlier number of this JOURNAL* an account was given of the preliminary results of applying lime to three areas of permanent grass for hay, which had been under definite manurial treatment for a number of years. Broadly speaking, it was found that considerable increase was brought about by liming areas receiving artificial manures containing sulphate of ammonia, but that where organic manure, such as dung, was applied, with or without artificials, the tendency was for liming to decrease the yield. These experiments have been continued, and demonstrate the correctness of the preliminary results.

* September, 1925, pp. 504-512.

At the end of 1919, three plots (A, B, C; see Table I for manuring) were subdivided and given light and heavy dressings of lime, the remaining third being unlimed.*

Owing to the initial variation in the soil acidity, the corresponding dressings on the three plots varied in quantity, but the amounts on the two plots receiving dung were sufficiently alike to admit of a fair comparison of results. Lime has been applied on three occasions, early in 1920, 1924 and 1928, and figures are thus available for two complete liming courses and part of a third.

TABLE I.—MANURING AND LIMING OF PLOTS A, B, C

	Manuring	*Light liming* lb. per acre. Applied 1920, 1924, 1928	*Heavy liming* lb. per acre
A (Plot 19) ..	Dung every fourth year (14 tons per acre) ..	570	3,150
B (Plot 20) ..	Dung every fourth year (14 tons per acre), nitrate of soda and mineral manures in intervening years (*e.g.*, dung 1905, artificials 1906, 1907, 1908) ..	570	2,772
C (Plot 18) ..	Sulphate of ammonia, potash, magnesia and sulphate of soda every year	3,951	6,788

With Dung Only (Table II, Plot A).—On the first two courses, the application of lime, one year before the dung, had little influence on yield, but, after the organic manure had been put on, the crop from the limed plots fell considerably. At the third application, in 1928, the heavy dressing caused an immediate and considerable drop in yield, possibly indicating a cumulative effect of the earlier treatments, accentuated by the extra supply. The aftermath was reduced with both dressings almost every year, the difference between the two not being very marked. For ease of reference all the crops for each four-year course of liming have been added together and averaged, and in addition, for purposes of comparison, the yields have been calculated as percentages of the crops on the unlimed portion of the plot for each course.

With heavy dressings of lime, the reduction of total crop in each period has been remarkably steady, 83·5, 81·8 and 79·4 per cent. of the unlimed crop being produced in successive periods. With the lighter dressing, the harmful effect seems

* The light dressing was determined by a colorimetric method based on the hydrogen-ion concentration of the soil, the heavy dressing on the Hutchinson-Maclennan method of estimating lime requirement.

TABLE II.—PLOT A

(*a*) *Average yield of hay, in cwt., per acre per annum*

Liming	*Over period* 1920-3 1st Crop	2nd Crop	Total	1924-7 1st Crop	2nd Crop	Total	1928-9 1st Crop	2nd Crop	Total
None ..	28·0	18·3	46·3	27·3	12·3	39·6	9·7	3·2	12·9
Light ..	23·2	15·5	38·7	25·7	8·8	34·5	10·2	1·8	12·0
Heavy ..	21·5	17·2	38·7	24·3	8·1	32·4	8·4	1·8	10·2

(*b*) *Crop as above, expressed in percentage of unlimed*

Liming									
None ..	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Light ..	82·8	84·6	83·5	94·1	71·2	87·0	105·5	58·3	93·8
Heavy ..	76·6	93·9	83·5	88·8	66·3	81·8	86·7	57·5	79·4

to be wearing off as time goes on, the percentages with lime being 83·5, 87·0 and 93·8 of the unlimed.

With simple organic manuring, the composition of the herbage is not affected to any marked degree. Considerable variations occur from year to year, due to seasonal effects, and the only constant change seems to be a tendency towards reduction of bent grass (*Agrostis*) and sweet vernal grass (*Anthoxanthum*), particularly with heavy liming. One very noticeable feature was the large proportion of meadow pea (*Lathyrus*) after the first two occasions that the lime was put on (Table III), followed by a return to the normal quantity till the next lime application, but as this also occurred on the unlimed portion of the plot it was obviously seasonal and not associated with the effect of liming. The increase did not occur in 1928, after the third application.

TABLE III.—PERCENTAGE OF MEADOW PEA (*Lathyrus pratensis*)

	Unlimed	*Light liming*	*Heavy liming*
1919	6·0	6·0	6·0
1920	12·3	17·9	8·3
1921	4·8	2·1	3·4
1922	7·4	5·8	6·9
1923	7·2	9·2	15·5
1924	19·5	17·8	20·5
1925	3·9	3·1	1·3
1926	2·3	1·3	0·9
1927	1·2	1·1	1·0
1928	—	—	1·0

The danger of reduced hay yield, where lime is used in conjunction with organic manure on heavy land under grass, is emphasized by another plot on the same field, which receives dung and fish guano alternately every second year and 2,000 lb. per acre of lime every four years. Here again the hay crop is considerably less where lime is applied, the degree of harm varying with the season.

The reduction of yield due to liming is evident in both first and second crops to a very similar extent, and has amounted

TABLE IV.—YIELDS FROM PLOT RECEIVING DUNG, 1921, 1925, 1929
FISH GUANO, 1919, 1923, 1927
LIME, 1920, 1924, 1928

Liming	1920-3 1st Crop	1920-3 2nd Crop	1920-3 Total	1924-7 1st Crop	1924-7 2nd Crop	1924-7 Total	1928-9 1st Crop	1928-9 2nd Crop	1928-9 Total
(a) *Average yield of hay, in cwt., per acre per annum*									
Unlimed	43·4	10·2	53·6	43·0	16·4	59·4	17·7	3·8	21·5
Limed ..	35·7	8·2	43·9	38·3	15·5	53·8	15·3	2·7	18·0
(b) *Crop as above, expressed in percentage of unlimed*									
Unlimed	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Limed ..	82·1	80·4	81·8	89·1	94·5	90·6	86·4	72·7	84·0

to 20 per cent. or more on occasion, being considerably affected by season. In most years the depreciation on the limed area is quite obvious while the crop is standing, especially as regards its relative density.

Combination of Dung with Artificial Manure (Table V, Plot B).—This combination has a different effect upon the quantity and quality of hay produced compared with dung used alone, when lime is applied in each case. With *light* applications of lime, the initial effect was to improve the colour of the grass and bring about a considerable increase in crop, amounting to 18·4 per cent. over the first four years' course for the first crop yields. After the second application in 1924, the improvement was rather less, 12·9 per cent., and after the third, in 1928, the first crop was lower than on the unlimed portion. The second crops throughout were reduced with light liming, but not enough to wipe out any improvement on the first crop. The reduction after repeated liming suggests that the earlier dressings had brought the soil to such a condition that there was no more possibility of improvement with lime, and to a point where further additions of lime caused harm on account of the organic manures applied, as on the plot (A) receiving dung only. This idea is supported by the effect of the heavy dressings, which at first had little influence on the yield, but which, since the second liming, have reduced both the first and second crops to less than those on the unlimed portions.

TABLE V.—PLOT B

Liming	1920-3 1st Crop	1920-3 2nd Crop	1920-3 Total	1924-7 1st Crop	1924-7 2nd Crop	1924-7 Total	1928-9 1st Crop	1928-9 2nd Crop	1928-9 Total
(a) *Average yield of hay, in cwt., per acre per annum*									
None ..	32·1	16·7	48·8	35·7	9·4	45·1	16·3	2·9	19·2
Light ..	37·9	13·4	51·3	40·4	7·2	47·6	15·6	2·0	17·6
Heavy ..	33·5	·15·6	49·1	32·6	6·1	38·7	15·0	1·8	16·8
(b) *Crop as above, expressed in percentage of unlimed*									
None ..	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Light ..	118·4	80·1	105·2	112·9	76·8	105·4	95·7	69·0	91·7
Heavy ..	104·6	93·3	100·8	91·3	64·5	85·7	91·5	62·9	87·1

A comparison of the percentage figures given in Table II (*b*) and V (*b*) shows that the adverse effect of liming with organic manures is considerably lessened at first by the presence of artificial manures, but that if liming is repeated at regular intervals this benefit disappears. For instance, at the end of 1923 no reduction of total crop had occurred with heavy liming in conjunction with dung and artificials, against a 16·5 per cent. reduction with dung only. After another four years, however, a drop of 14·3 per cent. had occurred in the former case against 19·2 per cent. in the latter, which represents a considerable levelling up due to the extra application of lime. No further change is yet obvious after the third dressing in 1928, but only two years' figures are yet available.

Where artificials and dung are both used, liming has had no constant influence upon the constitution of the herbage, even where heavy dressings are used. Seasonal changes are rather large, especially in years in which meadow pea (*Lathyrus pratensis*) is plentiful, as then grasses tend to be more drastically reduced than are the miscellaneous plants or weeds.

After the first light application of lime in 1920, the herbage was much improved in quality, chiefly owing to the better all-round growth of the majority of species, rather than to the encouragement of a few plants only. With the subsequent reduction in crop due to repeated liming this initial benefit disappeared.

Artificial Fertilizers containing Nitrogen used without Organic Manure.—In this case (Table VI, Plot C), liming has a totally different effect. On the plot observed, no phosphate was given and the nitrogen was applied as sulphate of ammonia. After the first application of lime, with either dressing, the first crops were heavier than those on the unlimed areas, but this was counterbalanced by lighter second crops, so that at the end of the four-year course no appreciable difference in total crop was obtained (Table VI, *a*). After a second dressing the improvement in the first crops due to liming became more marked, the heavier dressings giving the better results. At the same time the heavy dressings gave a better second cut, though with the lighter dressings this still tended to be slightly below that on the unlimed area. The net result was the very appreciable increase of 38·0 and 64·2 per cent. with light and heavy liming respectively over the second four-year course (Table VI, *b*), and there are indications that this improvement will be even greater during the present course, 1928-31, though

this will be partly affected by the unusual seasonal conditions in 1929, discussed later on in this article.

TABLE VI.—PLOT C

(a) *Average yield of hay, in cwt., per acre per annum*

Liming	*Over period* 1920-3 1st Crop	2nd Crop	Total	1924-7 1st Crop	2nd Crop	Total	1928-9 1st Crop	2nd Crop	Tota
None ..	23·5	21·7	46·2	19·9	15·5	35·4	4·1	2·3	6·4
Light ..	30·2	12·8	43·0	34·4	14·9	49·3	15·1	2·0	17·1
Heavy ..	31·2	14·8	46·0	40·0	18·1	58·1	21·3	3·1	24·4
(b) *Crop as above, expressed as percentage of unlimed*									
None ..	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Light ..	128·4	58·8	95·0	173·1	96·3	138·0	362·9	86·8	265·4
Heavy ..	132·3	68·3	101·6	201·5	116·4	164·2	511·9	135·2	378·6

On this plot, not receiving any dung, liming has had a marked influence on the composition of the herbage. There has been a steady increase in the proportion of grasses present, with a corresponding drop in the miscellaneous plants or weeds. The increase in grasses is largely due to foxtail (*Alopecurus pratensis*), which always responds to good feeding and liming. Cocksfoot (*Dactylis glomerata*) has increased, and oat grass (*Arrhenatherum avenaceum*) has also become more plentiful with the heavier dressing. At the same time the less desirable grasses, such as bent grass (*Agrostis* spp.) and sweet vernal grass (*Anthoxanthum odoratum*), have decreased in amount, as also has sorrel (*Rumex acetosa*), though the reduction in that case has been very gradual and somewhat slow in becoming evident.

The benefits of liming in this case have been becoming more and more apparent every year. The herbage on the unlimed area has been extremely uneven, tussocky, weedy, with relatively little top growth and a generally dishevelled appearance. Year after year, the limed areas have improved till now they are covered with a well developed, even herbage, with plenty of top as well as bottom grass. In 1929 the difference was most striking, owing to the abnormal seasonal conditions. The winter of 1928-9 was very cold, with exceptional frosts, the mean temperatures for January and February being 4·4° F. and 8·0° F. below the averages for the previous fifty-one years. This was associated with a drought, with less than half the usual amount of rain, only 2·613 in. falling during the first three months of the year, instead of the average (over the previous seventy-eight years) of 6·349 inches. This was followed by further droughts and periods of excessive sunshine right up to September and October respectively, and the first and second hay crops of 1929 suffered accordingly.

After the early frost and drought, the unlimed part of the plots receiving dung and artificials became brown, with practically no new growth, and yielded an almost negligible first crop of 2.68 cwt. per acre, while the limed portions were green and relatively well grown, giving crops of 28·77 and 31·86 cwt. per acre with light and heavy liming respectively.

This strikingly beneficial effect of liming was noticeable during the same season on other plots receiving various combinations of manures, but always where sulphate of ammonia was the source of nitrogen supply.

After the adverse winter conditions, the herbage on the unlimed parts of these plots appeared to be dead, forming a light yellowish-brown mat which stood out in striking contrast to the brownish-green colour on the adjacent limed areas and those receiving no sulphate of ammonia in their manurial scheme. When growth started on the latter areas the winter-killed, unlimed plots did not improve, and they remained brown and almost devoid of new vegetative growth throughout the season. The abnormally dry summer doubtless had much to do with the failure to recover, and must have accentuated the original mischief. In December, 1929, there were evidences of recovery, the degree depending upon the manuring. With sulphate of ammonia alone without lime, the plot was becoming fairly well covered with dark green, grassy tussocks, still surrounded by a good deal of bare ground. Where minerals were associated with ammonium sulphate, very little improvement had taken place, and the plots were still covered with a mat of dead herbage, with a few tussocks of green grass or sorrel in places. One striking feature is the beneficial action of silicate of soda when applied to unlimed areas dressed with heavy doses of ammonium sulphate and minerals. Here the alkali in the silicate of soda seems to have acted like a dressing of lime, and the plot showed very considerable recovery, being almost covered with large tufts of Yorkshire fog (*Holcus lanatus*), with comparatively small areas of bare ground in between.

The application of lime to manurial combinations containing sulphate of ammonia prevented the original winter-killing of the herbage. Under these conditions, the plots remained green, got away well in the spring of 1929 and gave relatively good crops considering the adverse influence of the later droughts. The contrast is well shown in the illustrations taken in June, 1929, before the hay was cut. In Fig. 1 the foreground is unlimed and the distant portions of the plots have received

lime. On the left is shown the comparative uniformity of growth on a plot receiving superphosphate only, and on the right the effect of adding sulphate of ammonia without and with the use of lime, the unlimed area being a dead mat of grass. Fig. 2 is a view down the length of a series of plots receiving sulphate of ammonia and minerals, lime being given to the right hand portion and not to the left, which shows the characteristic stretch of dead herbage with some tussocks of grass which had succeeded in re-establishing themselves.

In Table VII, the yields are given for 1929 and for the average for the preceding ten years for three pairs of plots showing the effect of liming with different manures, with and without sulphate of ammonia in each case (*a*), together with other figures giving the result of using nitrate of soda as a source of nitrogen (*b*), the basal quantity of nitrogen being the same in each case.

TABLE VII

(*a*) *Yield of hay, cwt. per acre. 1st crops*

	1929				1919-1928			
	With S/A		No S/A		With S/A		No S/A	
	No Lime	Limed	No Lime	Limed	No Lime	Limed	No Lime	Limed
No manure ..	2·77	12·10	6·27	6·86	15·69	19·09	12·21	11·73
Superphos. ..	1·02	24·06	10·18	7·42	19·76	30·13	17·49	14·66
Complete minerals ..	0·91	45·77	15·12	30·94	35·67	51·48	26·16	31·85
Averages for three plots ..	1·57	27·31	10·52	15·07	23·71	33·57	18·62	19·41
Ratio Limed No lime ..	17·39		1·43		1·42		1·04	

(*b*) *Yields, using sulphate of ammonia and nitrate of soda as source of nitrogen*

	1929				1919-1928			
	With S/A		With N/S		With S/A		With N/S	
	No Lime	Limed	No Lime	Limed	No Lime	Limed	No Lime	Limed
Complete minerals ..	0·91	45·77	39·8	40·3	35·67	51·48	56·93	51·90
Ratio Limed Unlimed ..	50·29		1·01		1·44		0·91	

Comparison of the ratio between the yields from limed and unlimed areas shows that in normal years, represented by the average figures for 1919-28, liming improves the crop considerably where sulphate of ammonia is used, by about 40 per cent. in this case, but in the absence of nitrogenous manuring it has very little definite effect. In the abnormal 1929 season, owing to the killing out of grass by ammonium sulphate, the limed crops were about twelve times the heavier, but in the absence of nitrogen an increase of 40 per cent. only was

FIG. 1. (*Left*) Plot receiving superphosphate only.
(*Right*) Plot receiving superphosphate and ammonium sulphate.
The parts of the plots in the background have received dressings of lime every four years, those in the foreground have remained unlimed. Extensive winter killing of herbage in the latter case.

FIG. 2. View down Rothamsted grass plots taken in June, 1929. Left foreground shows unlimed plots receiving ammonium sulphate with various combinations of minerals; right, effect of lime with the same manures.

THE VARYING EFFECT OF LIME ON GRASS LAND WITH DIFFERENT SCHEMES OF MANURING.

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recorded. Comparing the effect of sulphate of ammonia with nitrate of soda the discrepancy in ratio was still more marked. These figures draw attention to the need of care in the use of sulphate of ammonia as a dressing for grass land, and to the advisability of combining some measure of lime application with this form of nitrogenous manuring, unless it is certain that an adequate lime supply is present in the soil. The trouble was obviously a question of soil conditions and not of excessive nitrogen supply, because (1) the harmful effects were mitigated by dressings of lime and (2) plots receiving the same nitrogen dressings in the form of nitrate of soda were not affected by the winter weather conditions, and gave normal crops where no lime was applied.

The variation in the effect of lime, according to the manurial system adopted, is shown in other cases besides those described above, *i.e.*, its harmful action on yield where organic manures are utilized, and its beneficial effect in the presence of sulphate of ammonia.

On the heavy loam at Rothamsted, unmanured areas cut for hay year after year show no response to liming, the average crops having been practically identical over long periods. With nitrate of soda alone, the result is the same, although in this case liming has only been in force for the past ten years.

TABLE VIII.—YIELD NOT AFFECTED BY LIMING

		Mean crop in cwt.		
		1st Crop 1910-1919	*1st Crop* 1920-1929	*2nd Crop* 1920-1928
Plot 3.	Unmanured—			
	Not limed ..	9·84	11·43	6·40
	Limed ..	9·45	12·04	5·80
Plot 17.	Nitrate of Soda—			
	Not limed ..	22·83	23·09	10·40
	Limed ..	—*	23·38	9·67

* Second crops, 1910-1919, are not included, because the data for that period are incomplete in several respects.

With certain unbalanced mineral dressings, and with combinations of nitrate of soda and minerals, liming has a detrimental effect upon yield.

With a complete mineral dressing, including phosphate and potash in addition to the other salts, liming has proved decidedly beneficial to first crop yield, as is shown in Table IX, with little effect on the second crop.

Where phosphate alone has been supplied as superphosphate (Table X), a big reduction of yield with liming occurred in the period 1910-19, but the depreciation was less in the succeeding

TABLE IX.—AVERAGE YIELD (IN CWT.) OF PLOT 7—MIXED MINERAL MANURES

	1st Crop 1910-1919	1st Crop 1920-1929	2nd Crop 1920-1928
Not limed	26·3	26·9	14·9
Limed	31·6	33·1	13·3

period 1920-1929, though it still appeared in both first and second crops. With mixed mineral dressings, from which potash is omitted, lime also decreases yield considerably, but in this case the loss has been consistently great over the whole twenty years under consideration.

Although with nitrate of soda alone, the yield is not affected by liming, and with mixed minerals it is improved, yet if minerals are applied after the land has been dressed with nitrate for some years a marked reduction of yield occurs with liming. Further, if nitrate and minerals are applied together a similar reduction is observed, with either light or heavy dressings of nitrate. This effect shows quite soon, as it is equally evident whether liming was started in 1920 (Plot 14) or 1903 (Plot 16).

TABLE X.—YIELDS ADVERSELY AFFECTED BY LIMING

		Mean crop in cwt. 1st Crop 1910-1919	1st Crop 1920-1929	2nd Crop 1920-1928
Plot 4.	Superphos.—			
	Not limed ..	17·06	17·60	7·98
	Limed ..	11·57	16·46	6·65
Plot 8.	Mins. without potash—			
	Not limed ..	16·75	17·60	10·47
	Limed ..	12·84	14·23	7·79
Plot 15.	Mins. after N/S—			
	Not limed ..	25·02	27·85	13·64
	Limed ..	—	24·21	10·90
Plot 16.	Mins. plus N/S light dressing—			
	Not limed ..	39·12	37·95	13·08
	Limed ..	32·54	35·82	11·61
Plot 14.	Mins. plus N/S heavy dressing—			
	Not limed ..	48·28	50·81	17·37
	Limed ..	—	47·11	12·12

From the above results, it is evident that the application of lime to grass land needs to be undertaken with due consideration of the condition and manurial treatment of the soil. The effect of lime naturally varies with the type of soil as well, but its action is not always beneficial. In conjunction with organic manure, or with such combinations of artificials as nitrate of soda and minerals, liming may cause considerable reduction of yield. On the other hand, on an acid soil, such as one rendered acid by repeated applications of sulphate of ammonia, lime increases the yield in ordinary circumstances, while under certain abnormal weather conditions, as severe frost and drought, it may induce good growth of grass, whereas in its absence the crop may be practically a failure.

* * * * * *

THE WORLD'S POULTRY CONGRESS, 1930

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THE Fourth World's Poultry Congress, which was opened at the Crystal Palace by H.R.H. the Duke of York on Tuesday, July 22, 1930, and lasted until Wednesday, July 30, was generally agreed to have been a success. The number of countries represented was 61, and the total membership approximately 2,300. Over 80,000 people visited the Congress Exhibition, of whom some 50,000 paid for admission. This attendance, considering the unfavourable weather which prevailed throughout the period, may be regarded as very satisfactory.

The Congress Proceedings.—Taking first the Congress proper, a brief review of the programme may be given. The majority of delegates registered at The Whitehall Rooms, Whitehall Place, London, S.W. 1, on Monday, July 21, receiving their membership badge and Congress literature, including, in addition to the Congress papers, the final programme, the Exhibition programme and catalogue, a guide to London and invitations to various social functions. The same evening, a reception by H.M. Government was held at Lancaster House, St. James's, where members were received by the Rt. Hon. C. Addison, M.D., F.R.C.S., M.P., Minister of Agriculture and Fisheries.

Papers.—The Paper-reading Conferences at the Crystal Palace commenced at 10 a.m. on the morning of Tuesday, July 22, and were continued throughout the Congress period. Each morning, five conference halls were devoted to the use of members for the reading and discussion of papers which dealt with every important aspect of poultry and small livestock husbandry. In all, 156 papers, prepared by specialists from all parts of the world, were thus presented and discussed. Each of the five conferences had an honorary chairman, two acting chairmen and a secretary. Interpreters were in attendance so that discussions could be carried on in English, French, German, Spanish and Italian. A sixth session, which

met on two mornings, was devoted to the subject of rabbits. Where found necessary, conference halls were equipped with amplifying apparatus for better hearing.

The complete set of papers to be presented was available in printed form before the opening of the Congress. Each paper was printed in English and summarized in English, French, German, Spanish and Italian. The papers for each of the six sessions (including the one for rabbits) were bound in a separate volume. The *résumés* of the papers in English and the other four languages were also separately bound; thus there were in all eleven volumes, each fully indexed. This arrangement did much to simplify the paper-reading programme and to facilitate discussion.

Entertainments.—A comprehensive programme of entertainment was arranged for members of the Congress. On the evening of the opening day, Tuesday, July 22, the British Broadcasting Corporation kindly organized a Military Band Concert at the Crystal Palace, when the B.B.C. Military Band was augmented by 80 performers. On Thursday, July 24, the members were the guests of the British Poultry Industry at a Reception and Conversazione held at the Palace. This function was organized by a Joint Hospitality Committee representing the Poultry Club, the Scientific Poultry Breeders' Association, the National Utility Poultry Society and the Utility Duck Club. There was a reception by the Presidents of these bodies, also a vocal and orchestral concert, and dancing and hospitality. On the evenings of Friday and Saturday, July 25 and 26, an Army and Royal Air Force Pageant was staged in the Crystal Palace Stadium. The salute was taken on the first night by Prince Arthur of Connaught, and on the second by Lord Thomson, Minister for Air.

On Monday, July 28, Sir Thomas Beecham with his opera orchestra, supported by the London contingent of the Handel Choir, numbering 2,500 voices, gave a performance of the "Messiah" in the Central Transept of the Palace. Later in the evening, there was a display of fireworks in the Palace grounds. On Tuesday, July 29, the Corporation of the City of London held a reception and conversazione at the Guildhall, at which the Lord Mayor and Sheriffs were present and received many of the Congress members.

Finally, on the concluding day, Wednesday, July 30, members were entertained in the afternoon, as guests of H.M. Government, at a garden party held at Windsor Castle.

In addition, the official delegates to the Congress, appointed by the respective Governments, were entertained by H.M. Government at a dinner held at the Hotel Victoria, Northumberland Avenue, London, W.C. 2, on Wednesday, July 23.

Tours.—A series of afternoon tours was arranged during the Congress. These tours comprised visits to well-known poultry establishments and to places of scenic and historic interest. In each case, hospitality was provided for those taking part. On Saturday, July 26, two all-day tours were run, one to Cambridge, which included visits to the various Colleges; the other tour took the form of a run through Essex. The tours were well attended; and in the two Saturday tours alone, nearly 600 Congress members participated. Mention may also be made of an early morning visit to Smithfield Market, London, when some 80 Congress members had an opportunity of seeing the methods of the London wholesale poultry trade, and were entertained at breakfast by the London Central Markets Tenants' Association.

Entertainment of Lady Members.—The lady members of the Congress were specially catered for by the Ladies' Sub-Committee, under the chairmanship of the Countess De La Warr. Visits to shops, private art collections, tours of London, etc., were supplemented by receptions given by well-known hostesses both in and near London. Countess De La Warr, Lady Cynthia Mosley, Lady Evelyn Guinness, Miss Haldane, C.H., Lady Solomon, Mrs. Alexander, the Marchioness of Salisbury, Lord and Lady Lee of Fareham and Mr. Gordon Selfridge were among the hosts and hostesses who kindly received parties of women visitors. The women members were also granted temporary honorary membership of the following Clubs: the English-Speaking Union, the Garden Club, the Overseas League and the Sesame Club. The English-Speaking Union and the Women's Institute section of the Forum Club both gave evening receptions. The programme as a whole was greatly appreciated.

The Congress Exhibition.—The two-fold character of the Exhibition—educational and commercial—needs to be emphasized. Of the various countries participating in the Congress, some 25 staged national exhibits which, collectively, occupied the whole of the North Nave of the Crystal Palace. These national exhibits were designed to show the position of the poultry industry in the respective countries, and the means by which its development had been and is being

fostered and promoted. Taken as a whole, the exhibits presented in pictorial form something akin to a bird's eye view of the poultry industry in the leading countries of the world. No pains had been spared by the countries concerned to make these exhibits worthy of the occasion, and many of them were particularly striking and attracted much attention. While poultry was the dominant feature, other aspects of industry were not debarred at these stands. Italy, for instance, presented a display of Italian art and literature, relating to poultry, which included marbles, bronzes and paintings of the seventeenth century; these being staged side by side with exhibits illustrating the latest developments in that country in poultry breeding and research. Other European countries included small sections of peasant art-work, and Austria gave some prominence to native wines.

A few examples will serve to indicate the attractiveness of this section of the exhibition. A popular feature at the United States stand was the section of a large mechanical hen, in which moving parts showed the digestive processes and the rôle played by various nutrients in the formation of eggs. At intervals, by means of a gramophone record, was given a descriptive explanation—purporting to emanate from the hen—of these processes in her internal economy. Another striking item at this stand was a large pendulum clock, each swing of the pendulum proclaiming the production of yet another 1,000 eggs in the United States, a forcible indication of the enormous production in that country. At all these stands, models, diagrams and charts were liberally employed to illustrate national schemes of education in poultry matters, or to show how poultry farming was carried on. For example, the procedure in a Dutch egg auction; the story of Danish co-operative methods; recent developments in educational work in Spain; the vigilance of the Swedish authorities to ensure the quality of the eggs exported; and the model, from Switzerland, of the poultry farm that lies at the highest altitude in the world. Of more spectacular items may be mentioned the immense panoramic relief map of Canada, from which, at intervals, gigantic eggs emerged to open and disclose cages of living poultry; another similar map in the Canadian Provinces exhibit, with moving trains and steamers to illustrate the transport and export of poultry produce; and the model of the Prince of Wales's Canadian ranch, of which an illustration is given in this issue.

Photo: London Panoramic Co.

FIG. 1. The Egg Marketing Demonstration of the Ministry of Agriculture and Fisheries. This formed the central feature of the Marketing Section of the United Kingdom National Exhibit. On the right (not shown in the view) was the Ministry's Poultry Marketing Demonstration and the Marketing Exhibit of the Scottish Board of Agriculture. On the left is seen the Northern Ireland Marketing Exhibit.

THE WORLD'S POULTRY CONGRESS, 1930.

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Fig. 2. The Irish Free State Exhibit.

Photos: London Panoramic Co.

Fig. 3. A Section of the Exhibit staged by the Canadian Provinces.

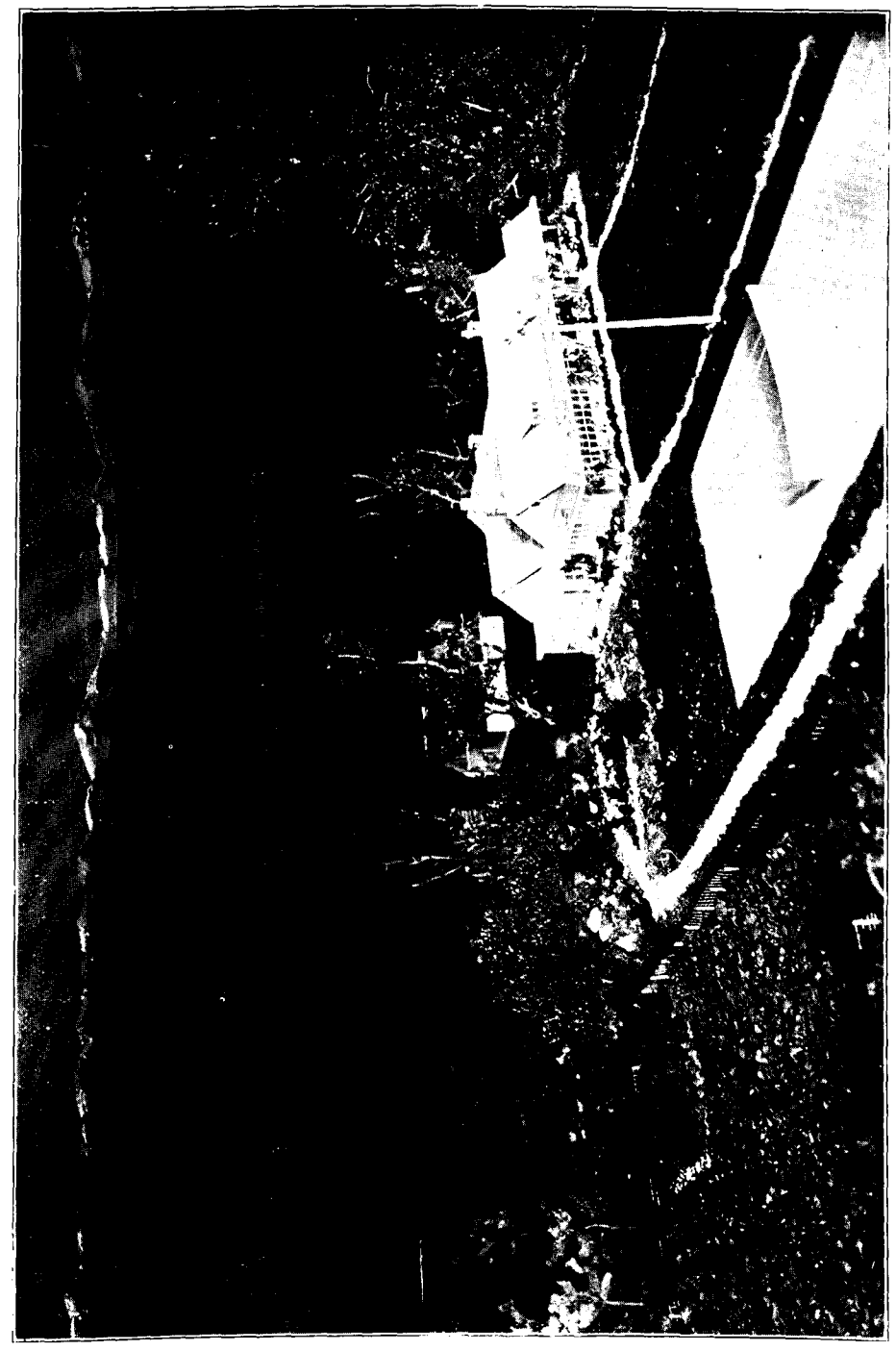


Photo: London Panoramic Co.

Fig. 4. A feature in the Canadian Exhibit. Model of a corner of the Prince of Wales's "E.P." Canadian Ranch, showing the residence with an impression of the foothills lying under the shadow of the Canadian "Rockies."

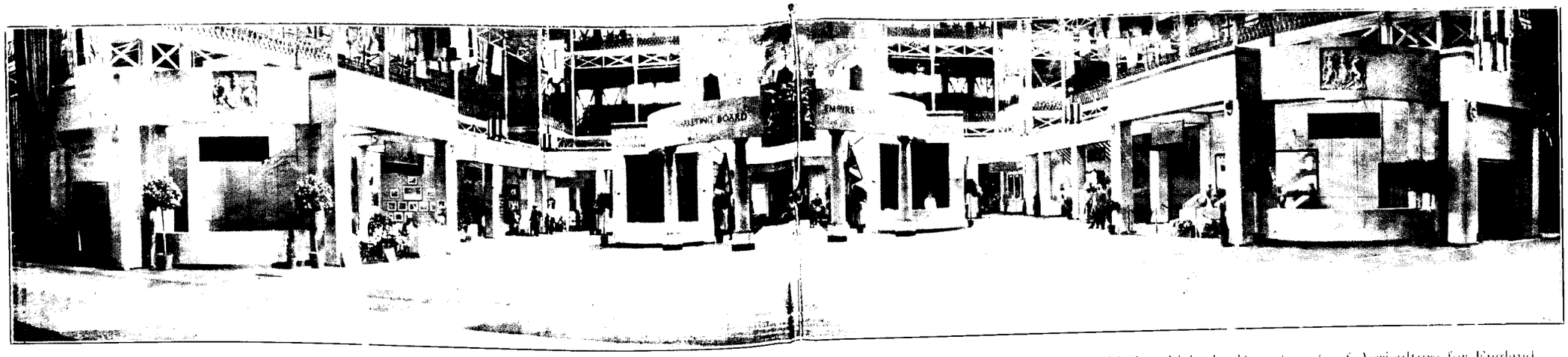


FIG. 5. The Pavilion of the Empire Marketing Board in the Central Transept of the Crystal Palace. In the centre is the United Kingdom Exhibit in which the Departments of Agriculture for England and Wales, Scotland, and Northern Ireland collaborated in demonstrating the great influence of education and research on the development of the poultry and small livestock industries. (*See p.* 677.)

FIG. 6. "Success," the striking symbolical tableau in the centre of the Education and Research Section of the United Kingdom National Exhibit. (*See p.* 677.)

Photos: London Panoramic Co.

FIG. 7. A few of the National Exhibits. General view looking up the Main Nave from the Central Transept.

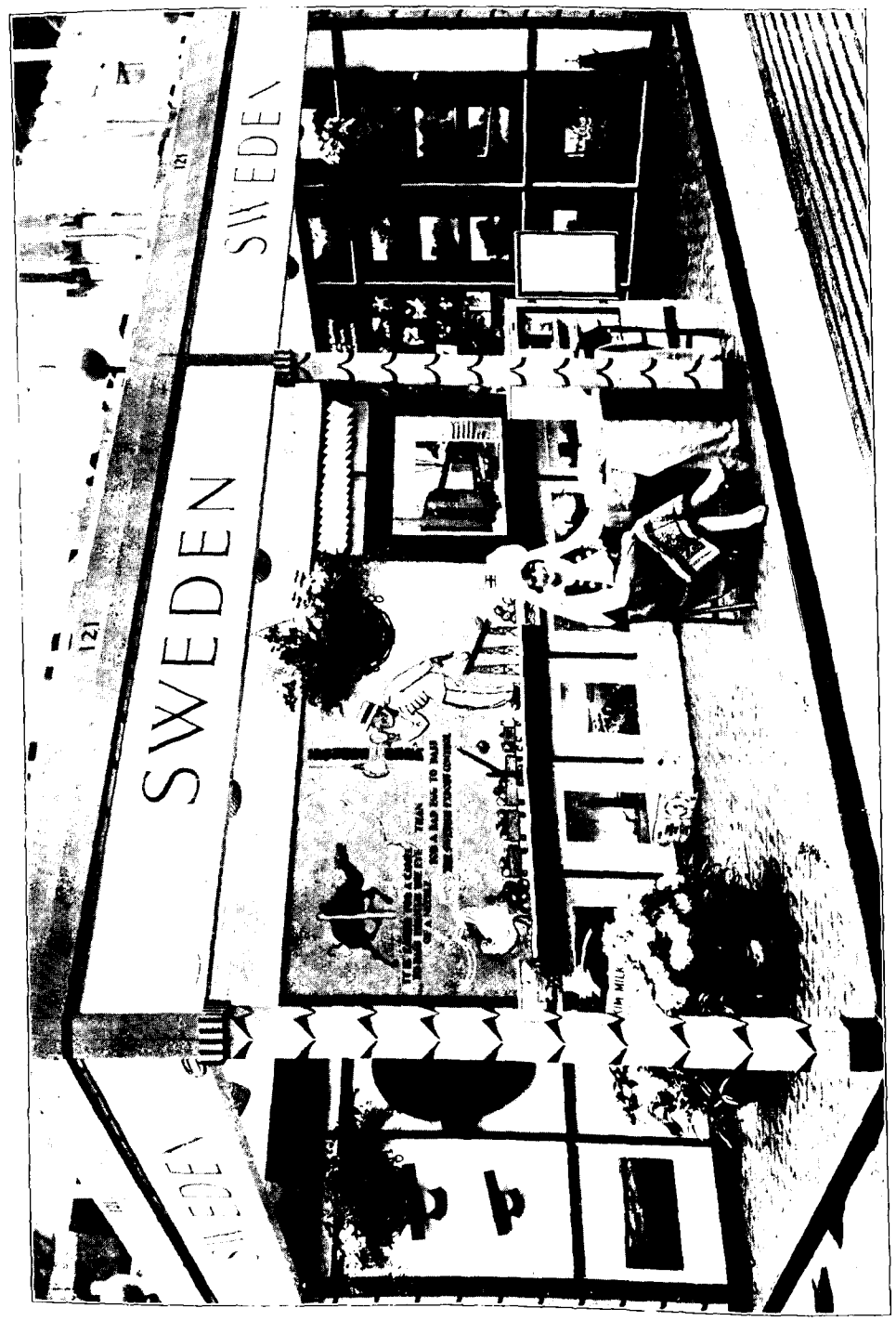


Photo: London Photographic Co.

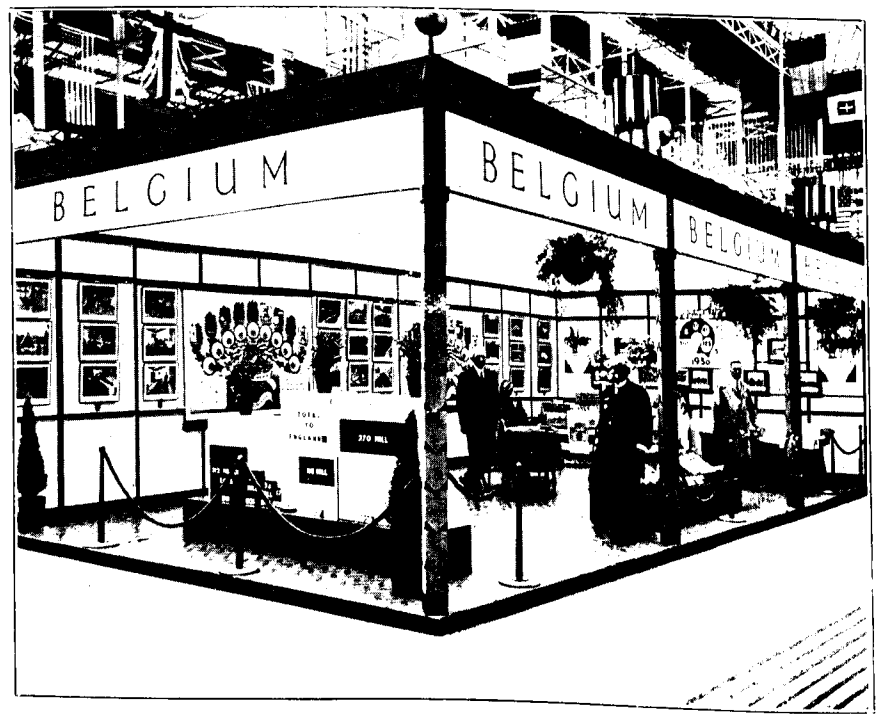
FIG. 12.—The Swedish National Exhibit.

The United Kingdom National Exhibit.—The United Kingdom exhibit was divided into two main parts. Housed in the stately pavilion of the Empire Marketing Board, which occupied the whole of one half of the Centre Transept of the Palace, was a special section illustrating the educational and research work in poultry husbandry that is being carried on in England and Wales, Scotland and Northern Ireland. The work of the research institutes, agricultural colleges, county advisory officers, etc., was portrayed in graphic form. The central tableau in this section—"The Gate of Success"—is shown in one of the accompanying illustrations. In this section, the rabbit industry was allotted a prominent place, and fur and wool garments, of all-British production, were effectively displayed by mannequins.

The other section of the United Kingdom exhibit, devoted entirely to marketing, was situated at the extreme end of the North Nave of the Palace. The central feature here was the stand of the Ministry of Agriculture and Fisheries, displaying the National Mark Scheme for eggs and poultry in England and Wales, the candling, grading and packing of national mark eggs being demonstrated on the centre stand, while on a stand to the right, the plucking (by machine), shaping, cooling and packing of table poultry was shown in operation. The apparatus used on the latter stand was described and illustrated in the last issue of this JOURNAL (September, 1930, pp. 599, 600). On a second stand to the right, the Department of Agriculture for Scotland depicted the procedure of the National Mark scheme in that country. Opposite, on the left of the centre stand, the Ministry of Agriculture for Northern Ireland presented, on a large stand, a very effective display illustrating the measures adopted in that country for improving the marketing of eggs and poultry.

The Commercial Exhibits.—Almost all the remaining available space in the main hall of the Palace was taken up by the commercial section of the Exhibition, which occupied the floor and most of the gallery of the South Nave. In this section, the greatest activity prevailed throughout the Congress; any misgivings that may have been entertained by trade exhibitors in the early days of preparation were quickly dissipated when the exhibition opened, and the various firms were unanimous in their appreciation of the opportunities afforded for doing business. Approximately, 50,000 square feet of floor space were devoted to trade exhibits,

Fig. 8. The Polish National Exhibit.



Photos: London Panoramic Co.

Fig. 9. The Belgian National Exhibit.

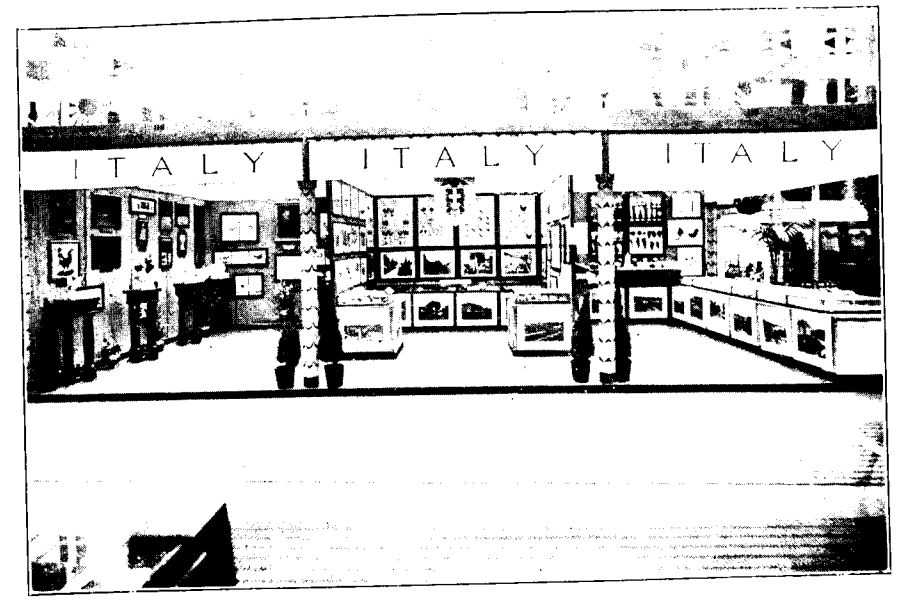
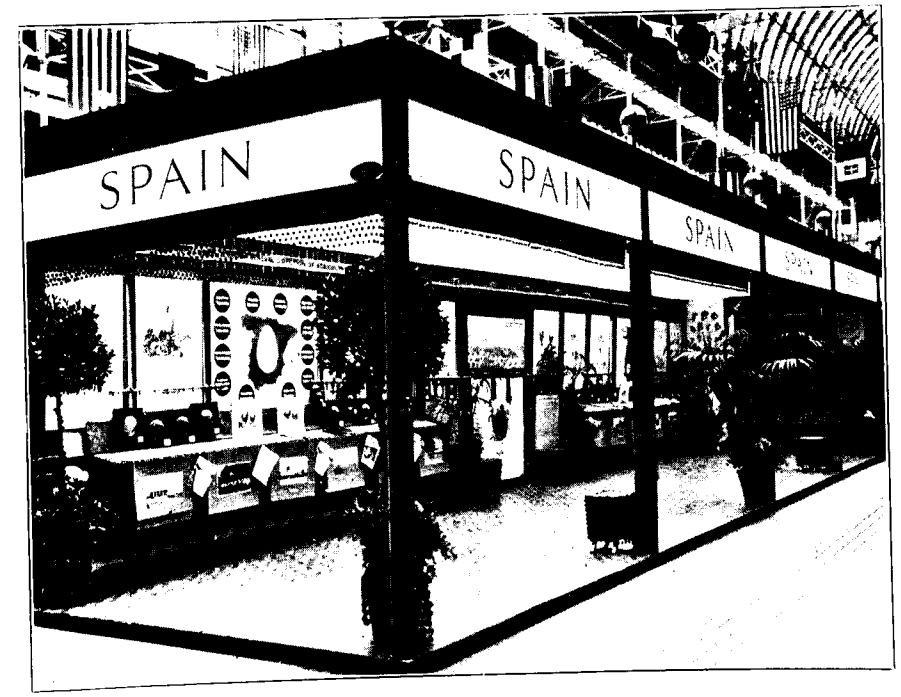


Fig. 10. The Italian National Exhibit.



Photos: London Panoramic Co.

Fig. 11. The Spanish National Exhibit.

these including everything of interest to the poultry industry, from the smallest items of equipment to electrically-operated incubators with a capacity of nearly three tons of eggs. Here were to be seen the latest developments in battery brooders, also electrically-operated, where day-old chicks from incubators start life on the "ground floor," proceeding upstairs as their size and weight increases, and only vacating the battery when ready for the table. Here also were shown machines that sorted eggs according to weight, candling, stamping and, finally, packing them for transport; machines that preserved eggs for a year; poultry houses and appliances of every description; and a great variety of foodstuffs—in short, every material requirement that the poultry keeper could possibly need in his business.

The Display of Livestock.—The livestock display, housed on the lower floor (Terrace level) of the Palace, in a portion of the main gallery, and in outside marquees, comprised a collection of some 7,000 head of the world's best stock in fowls, ducks, geese, turkeys, pigeons and rabbits, including breeds from the Argentine, Canada, the United States, Newfoundland, all the European states, and from countries ranging across Asia to the Eastern Archipelago. Practically every poultry breed of importance was represented; spotted geese, Roman geese, turkeys from their native habitats, runner ducks from the Netherlands East Indies, distinctive guinea fowl from Italy, white-legged, bare-necked and crested fowls from Central Europe, old English game birds, etc. Some of the—to English eyes—more exotic of these breeds were illustrated in this JOURNAL last month (September, 1930, p. 532). The main attraction of the display, however, centred in the modern breeds, shown on a scale never before attempted in this or any other country. The British entries in this section included, as one of the most important features, many of the birds which have obtained high records for egg production in the numerous trials officially recognized in this country.

In connexion with the livestock display, every effort was made to facilitate business. Sales bureaux, with interpreters in attendance, were provided in the main poultry section, and in the annexe allotted to pigeons and rabbits. In addition, an auction sale of stock, not previously sold, was held on the third day of the Congress.

Staging of the Exhibition.—No note on the Exhibition, however brief, would be complete without some reference to its general layout and staging. Uniformity in the design of

the stands was made a cardinal condition; thus the excellent tradition of homogeneity, inculcated by the British Empire Exhibition, and by modern exhibitions on the Continent, was maintained. As a harmonizing note with the grey paint of the Palace ironwork, a colour scheme of primrose yellow was adopted for the stands, relieved by herringbone flecking and stencilled motifs of poultry, rabbits, etc., in black. This colour note was heightened by gilded pear-shaped finials and by fascia boards in white with a good classic type of lettering in black. The design of the stands was the work of Mr. J. Stevens Lee, A.R.I.B.A., Superintending Architect of the Ministry of Agriculture and Fisheries, and their appearance evoked much favourable comment from both the press and the public. The attractiveness of this lay-out was further enhanced by a decorative scheme of flags, banners and plants, carried out by H.M. Office of Works under the supervision of Mr. J. Hooper, of that Department, which was also responsible for the excellent fitting up of the various conference halls, the Congress Club, etc. The decorative side of the Exhibition was also supplemented by special floral displays staged by leading horticultural firms.

Conclusion.—It is almost needless to say that the holding of a world congress, such as this, is only made possible by the loyal co-operation and unstinted efforts of large numbers of devoted workers. To them, the world over, the hearty thanks of the promoters are due. For the organization, in particular, of the United Kingdom contribution, acknowledgment must be made of the valuable services rendered by the various committees dealing with special sides of the work; of the whole-hearted efforts of the county poultry instructors working in their respective areas; and of the active interest and support given by the Council and Branches of the National Farmers' Union, and by the specialist poultry societies. The enthusiasm which characterized the preparations in this country was derived in no small measure from the example set by the Congress Presidents—Dr. Addison, M.P., the Minister of Agriculture and Fisheries, Sir Edward Archdale, the Minister of Agriculture for Northern Ireland, and Mr. W. Adamson, M.P., the Secretary of State for Scotland—and by Mr. F. C. Elford, of Canada, First Vice-President of the Congress and President of the World's Poultry Science Association. To Mr. Elford and to his co-adjutor, Sir Edward Brown, Hon. Past-President of the Poultry Science Association,

the Congress paid a graceful and merited tribute of appreciation. Last, but not least, to the Press, and particularly the specialist Poultry Press, are due the very cordial thanks of all concerned with the organization for the publicity given to the preparation and proceedings of the Congress and for the world-wide interest evoked thereby.

Of the success of a congress organized by this country, it is more fitting, perhaps, that the nation's guests should testify. The feeling of our visitors in this matter is sufficiently indicated by two of the various resolutions passed at the final meeting of the Congress on July 30. The first, addressed to His Majesty the King, reads as follows :—

> May it please Your Majesty :
>
> We, the Delegates and Members of the Fourth World's Poultry Congress, meeting in the Final Assembly, beg respectfully to present to Your Majesty our heartful appreciation of the manner in which your Government and Departments of State have organized this Congress and Exhibition, and for the unbounded hospitality accorded to us in the capital of your great Empire over which we hope you may long be spared to reign.
>
> Representing as we do sixty-one countries, we shall carry to our homes memories which can never be effaced of the most remarkable assembly ever held in connexion with any branch of Agriculture. It cannot fail to help in binding the Nations together and exert a potent influence in the days to come.

The other resolution, with which this brief review of the Congress may very fitly conclude, records that :—

> We, the Delegates and Members of the Fourth World's Poultry Congress, desire to convey to the Governments of Great Britain and Northern Ireland, and particularly to the Ministry of Agriculture and Fisheries, our deep indebtedness for the boundless welcome accorded to us, and our admiration of the organization of the Congress and Exhibition, the success of which, we are confident, will fully justify their having undertaken the responsibility for their great enterprise. Our assurance is that it will promote the prosperity of the British Poultry Industry and that its influence will be felt throughout the entire world.

* * * * * *

OBSERVATIONS ON NEMATODE PARASITES OF SHEEP IN EAST SUSSEX

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THERE are in East Sussex nearly 200,000 sheep, the density of the sheep population being approximately 525 per thousand acres. The distribution of sheep is not, however, uniform in the county, being more dense in the extreme east or Romney Marsh district and along parts of the South Downs.

Two widely differing breeds of sheep are found in the county —the Southdowns and the Romney Marsh. The Southdown is typically a breed of arable districts, whilst the Romney Marsh, or Kent, is pre-eminently a grassland sheep.

The elevation at which most Southdown flocks are kept ranges from 300 to 700 ft. above sea level; on the other hand, much of the sheep-grazing land of Romney Marsh is only a little above sea level. Again, the methods of grazing differ between the Southdown and the Romney Marsh breeds; the Southdowns, even when not folded, tend to cling together and graze in close proximity; the Romney Marsh sheep, on the other hand, usually scatter and are more individualistic in their habits.

Despite these wide differences, nematode parasites, or thread worms, are the cause of very heavy losses in both breeds. It must not be assumed that they are more prevalent in East Sussex than in other counties; probably the reverse, but possibly more attention has been given to their prevalence than in many other districts.

In addition to wide differences in type and habit of the two breeds, together with the varying elevations of the sheep districts, the methods of sheep farming are distinctly different. The typical Southdown flock is folded during the night on arable crops; usually, during the day, it runs on the hills or, towards lambing time, on lower-lying fields at the foot of the Downs. The Romney Marsh sheep, on the other hand, generally spends all its life on grass land. Despite these differences, nematode parasites are common to both. It is probable, however, that the losses due to these parasites, if abundant, are greatest amongst Southdowns, although the Southdown system of farming tends usually to keep the parasites in control. The arable cropping on a Southdown farm as a rule is not of an intensive character; the soils are often poor and thin, and sheep are rarely folded over the same land twice in a year. This practice has been instrumental in

giving the Southdown such an enviable reputation for health. Latterly, there has been a greater tendency to reduce the acreage of arable crops grown for Southdown sheep and to allow them a greater run on enclosed pasture and hill land. In certain instances this, or some other factor, has been responsible for an increase in parasitic diseases.

As already pointed out, the Romney Marsh sheep is practically never folded. The fertile tracts of soils in the extreme east of the county are amongst the most heavily stocked land in the country, and but for the practice, which has existed for generations, of removing the lambs, towards the end of August and September, from the Marshes to higher land in the Weald, where sheep are not usually kept, it is probable that thread worms would make sheep farming impossible.

An article in this JOURNAL* sets out very clearly the life-history of two worm parasites of sheep. As is well known to biologists, the classification of that group of organisms known as "worms" is somewhat arbitrary, and the life-history of the different parasites classed as "worms" are not very well understood by farmers. The control of these parasites, however, can only be carried out effectively when their life-history is understood.

Briefly, worm parasites may be divided into two groups, that of the flat worm type and that of the thread or round worm type. To the former belong the ordinary tape worm of sheep and the Liver Fluke. The life-history of the tape worm is still uncertain, but that of the Liver Fluke has been very fully worked out. The losses occasioned by the Liver Fluke are appreciated by sheep farmers, but in the writer's opinion far greater losses are occasioned by the round or thread worms than ever by Liver Fluke—at any rate in East Sussex. It is true that the losses may not be always so spectacular, but there is no doubt that they are far more widely distributed and far more frequently recurrent than in the case of Liver Fluke. It is also certain that they have a wider distribution as regards elevation than is the case with the Liver Fluke.

In the county of East Sussex, their distribution ranges from sea level to nearly 900 ft. above it, and there is no evidence to show that these nematode parasites cannot thrive as well at higher elevations as at the lower levels. In some of the cases investigated by the writer, no evidence could be found of the infested sheep having gone to a lower elevation than

* E. L. Taylor: "Stomach Worms in Sheep": April, 1929, p. 31.

several hundred feet above sea level. Again, these nematode parasites are far less dependent on climatic conditions than is Liver Fluke. Large-scale outbreaks of the latter coincide with wet seasons; outbreaks of thread worms may be just as active in dry as in wet seasons.

The article in this JOURNAL, already mentioned, describes two well-known thread worms—*Haemonchus contortus* and *Ostertagia circumcincta*, known as the "twisted wireworm" and the "lesser" stomach worm of sheep. *Haemonchus contortus* is widely distributed; indeed, it is rare to examine the fourth stomach of sheep without finding some of the parasites present. Their numbers vary enormously, and it would seem that sheep suffer but little when the parasites are few in number, but it is not uncommon to find the fourth stomach teeming with both males and females of the "twisted wireworm"—and then heavy losses inevitably occur. Farmers and shepherds are not always aware of their presence and, even when sheep are badly infested, they may escape observation unless they are suspected. When the fourth stomach of a sheep which has died is examined, they may escape observation owing to discoloration by the chocolate-brown fluid of the fourth stomach. It is, however, more easy to detect them if the stomach is examined shortly after the sheep dies or is killed.

If a small quantity of the contents of the fourth stomach is placed in a tumbler or a glass cylinder, water being added, the worms gradually drop to the bottom. By decantation, most of the colouring matter and sediment can be removed and, in the clear liquid, the thread worms can be easily seen.

The persistency of these parasites is remarkable. In one instance a lamb which had been buried for two or three days was dug up and examined; both male and female "twisted wireworms" were still found to be alive. Even after they had been removed from the fourth stomach and kept for some little time, they were alive and active.

In East Sussex, another thread worm, known as *Chabertia ovina* (formerly *Sclerostomum hypostomum*) is found. Although fairly widely distributed, it is not so commonly found as the "twisted wireworm." Unlike the latter, the head appears to be blunt and enlarged; it is somewhat shorter but thicker than the "twisted wireworm," and is generally considered to be innocuous: indeed, Ransom states: "This species appears to be comparatively harmless." Its habitat is in the intestines and not the fourth stomach. It is true that in

outbreaks of parasitic diseases, amongst flocks in East Sussex examined by the writer, it is rare to find affected sheep where the "twisted wireworm" is absent; but, in a number of affected sheep examined, they were in such small numbers that whether they were solely responsible for the serious losses seems questionable. On the other hand, *Chabertia ovina*, for which there is no popular name, was most abundant.

The photographs accompanying this article demonstrate that, if the life-history of these nematode parasites is understood, and if affected sheep are subjected to treatment which breaks the life cycle of the parasite, then in the majority of cases the sheep recover and will produce healthy lambs.

The ewes in Fig. 1 were taken from a Southdown hill farm situated several hundred feet above sea level, and no evidence was forthcoming that the sheep had been on wet, low-lying land. For some years, there had been heavy losses amongst the lambs and also considerable mortality amongst the ewes. During the early part of 1928, the flock, despite good feeding and constant drenching with medicines, was in a deplorable condition, although the majority of the ewes were not in quite the emaciated condition of those shown in the photograph. Those shown in the photograph were picked out as being the worst in the flock and certain to die if kept on the farm.

The most obvious symptom of sheep severely attacked by these parasites is extreme emaciation; as will be noticed the backbones protrude, in fact the bones show all over the body; in some cases scouring is noticeable, but emaciation may be present without much scouring. There is also a characteristic appearance of the head, which seems to be too large for the body, and dropsical swellings appear beneath the jaws, whilst in practically all cases after death or when the sheep are killed there is an abnormal quantity of body fluid present.

The ewes were removed to the Agricultural Institute Farm at Plumpton and immediately began to make excellent recovery. This recovery was due neither to medicinal treatment nor to artificial feeding, but was attributable to the simple fact that the ewes were put on fresh land free from parasites. Sheep examined from the farm, from which the ewes were taken, were known to be infested with *Haemonchus contortus* and very heavily with *Chabertia ovina*.

The second photograph was taken in December, 1928, and it will be seen that remarkable progress had been made. The ewes were mated and, subsequently, one was killed and examined, but parasites were not found. The third photograph,

FIG. 1.—Photograph, taken July 18, 1928, of ewes removed from a flock known to be infected with *Haemonchus contortus* and *Chabertia ovina*.

FIG. 2.—Photograph of same ewes, as above, taken December 14, 1928.

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FIG. 3. Photograph of ewes and lambs, taken May 10, 1929.

FIG. 4. Photograph of ewes and lambs, taken July 16, 1929.

taken in May, 1929, shows that the five ewes had produced six strong, healthy lambs. The ewes still received no concentrated food and by this time they were fat, as, also, were the lambs.

A further photograph was taken in July, 1929 (Fig 4), just after the ewes had been shorn. It seems almost incredible that such complete recovery should have been made from their emaciated condition of twelve months previously, but not only were the ewes then fat and fit for the butcher, but the lambs, which were born late, are seen to be as fat and nearly as big as the ewes.

This demonstration was intended to emphasize the fact that, with thread worms, a period of some ten days elapses after the passage of the eggs from the host before the infective stage is reached, and that if this is realized and acted upon the parasites may be controlled or eliminated from a flock. If sheep could be infected again by the eggs immediately they dropped from the host it would be practically impossible to cope with the parasites. Further, if it were possible for the parasites to complete the life cycle within the host, recovery would be impossible.

It should be very clearly understood, however, that although such a remarkable recovery occurred with the ewes removed from this heavily infested flock, similar results would only temporarily be obtained by removing a large flock on to fresh land unless the sheep were moved to fresh fields at short intervals so that neither ewes nor lambs could pick up the parasites when in the infective state. Further, it should be remembered that such land, after the passage of the flock, would be liable to cause parasitic trouble in sheep subsequently passing over it.

Since the last photograph was taken, one of the lambs born has been examined. No trace of parasites or of eggs could be found.

The flock, from which the ewes were taken in 1928, was kept away from the hill grass land on which it had been running previously, and both ewes and lambs were kept entirely on arable land. Even on this heavily infected farm, the majority of the ewes made complete, if not such spectacular, recovery as in the case of those shown in the photographs.

The writer is much indebted to both the owner of the flock in question and his agent who, in the interests of other flock masters, placed not only their knowledge and information but also the flock at his disposal for experimental and demonstration work.

The following summary of the condition of the flock prior to 1928 has been kindly supplied by the owner's agent :—

The year 1926 was considered to be the worst year with the lambs, when it was estimated that the loss was approximately 40 per cent. of the total. Out of some 200 lambs, only 42 could be sold at the local fairs, the customary selling places of Southdown lambs. These were the pick of the flock and were sold for 35s.6d. each. The remainder were retained and sold out in small lots during the winter ; the highest figure obtained was 40s.

During the following spring (1927) approximately 220 lambs were born and these at birth were healthy and strong. They were weaned in June, but as in the previous year began to fall away soon after weaning. During this year, 135 lambs were sold at the local sheep fairs and averaged only 35s. each. The majority were poor, although they had been drenched several times. Some 40 ewe lambs were kept back for the flock, together with about two dozen small ones. The ewes did not do well that year and many were in poor condition during the summer. The whole flock, both ewes and lambs, were drenched several times ; indeed, they had as much drenching as was considered safe, yet despite this, apart from lambs, some 20 ewes died.

In the autumn of 1927, 210 ewes were picked out for breeding. As usual, these ewes had improved in condition considerably during the latter part of the summer and early autumn. The following spring, 220 lambs were born, of which about 20 died, some losses being possibly attributable to bad weather at lambing-time. The lambs again did badly and, if anything, were in worse condition than in the previous year. The owner was only able to sell at the local fairs 111 lambs, which averaged approximately 30s. each. Some 40 ewe lambs were again kept together with a number of small ones that were so poor as to be unsaleable, whilst some 20 lambs died during the summer.

It was during the spring of 1928 that the writer first inspected the flock, and as the agent for the owner wrote—"You well know the wretched condition they were then in ; we had many losses that year and quite 30 ewes died."

At this point, however, it was decided, despite the expense which would be involved, to keep the flock away from the hill pastures. The lambs when sold the following year, 1929, then averaged at the sales 56s. each, which, as the owner's agent pointed out, was "a vast difference to prices previously obtained."

The agent's statement (taken from a letter to the writer) —"For three years we drenched continually and *with little effect*"—is full of significance. Continuing, he says : "Although I have only given you the losses, I have on two or three occasions sold a number of ewes for only a few shillings per head as their condition seemed hopeless, since they were a disgrace to be seen and only helped to pile on the losses . . . The ewes usually picked up in condition during the autumn and fell away again in the early summer. We always had a good supply of green food for the sheep all the year round and also fed liberally on dry food during the winter months, but this made no difference when the summer months arrived. They were in as bad condition in 1927 as in 1928 when you saw them."

Conclusion.—The prices obtained from the sales of the ewes and lambs shown in the photographs when sold are of especial interest.

(1)	3 ewes sold at 65s. each	=	£9 15 0
(2)	2 ,, ,, 56s. ,,	=	5 12 0
(3)	3 lambs sold at 72s. 6d. ,,	=	10 17 6
(4)	2 ,, ,, 70s. ,,	=	7 0 0
			£33 4 6

The sum realized for the three ewes was higher than the price for any ewes sold in Lewes Market since the Christmas Fat Stock Show, 1928, whilst the price for the lambs, 72s. 6d., was the highest price for lambs sold on that day. When the condition of the emaciated ewes (Fig. 1) is considered, the enormous economic losses due to nematode parasites may, to some extent, be realized.

* * * * * *

THE FEEDING VALUE OF ROOTS, HAY AND STRAW

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WHILE the composition and feeding value of the concentrated foodstuffs commonly purchased by farmers has been widely discussed, less attention, generally speaking, has been paid to the part played by the bulky, home-grown foods—roots, hay and straw—included in live stock rations. Yet an examination into the food constituents supplied by most feeding rations will show that by far the larger proportion of such constituents is derived from foods produced on the farm. As an instance may be cited the following commencing ration, recommended by one of the agricultural colleges last winter for fattening cattle, and calculated to give 1½ lb. daily live weight increase :—

		Protein content	*Starch equivalent*
80 lb.	swedes	0·88	5·84
6 „	hay (seeds)	0·37	1·44
	straw *ad lib.* (say, 7 lb.) ..	0·07	1·19
2 „	oats	0·16	1·20
1½ „	barley	0·10	1·06
½ „	ground nut cake (decort.) ..	0·21	0·36
		1·79	11·09

In the above ration it will be seen that the bulky home-grown foods supply 1·32 lb. of the total 1·79 lb. protein fed, and 8·47 lb. starch equivalent of the total 11·09 lb. It is only fair to state that the ration quoted was framed with the object of making use of the maximum amount of home-grown foods, hence the small proportion of ground nut cake included. Even where the quantity of purchased concentrates included in a ration is much larger than that given above, it is still true to say that the proportion of food constituents supplied by the home-grown foods is greater than is generally realized.

The significance of this fact lies in the variation which occurs in the feeding value of these home-grown foods, a variation that is much wider in range, and more difficult to allow for, than any occurring in purchased concentrates. In this connexion, the term "feeding value" may be regarded as embracing dry matter content, composition in terms of food constituents, digestibility and palatability.

Roots.—The composition of swedes and turnips, the most widely-grown root crops, is varied by several factors. Throughout the trials, conducted for over twenty years at Cockle Park, the Northumberland County Experimental Station, the average percentages of dry matter content were, approximately, as follows :—Swedes, 12 per cent., turnips, 9·6 per cent., soft turnips, 8·25 per cent. This means that 20 cwt. of swedes, 25 cwt. of turnips and 29 cwt. of soft turnips contain the same weight of dry food material ; and the results of many feeding tests carried out at Cockle Park show that, for cattle and sheep feeding, the dry matter of swedes and turnips has practically the same feeding value. This conclusion applies to different varieties of swedes and turnips.

It will be noted that this classification of the root crops into swedes, turnips and soft turnips is a modification of that sometimes adopted by seedsmen. The reason for this is that, in the trials mentioned, the three yellow turnips, Early Sheepfold, Selected Fosterton and Centenary, although possessing yellow flesh of the same kind as ordinary turnips, were found to produce a dry matter content so low as to make it necessary to place them, on a food value basis, in the same group as soft turnips. Some farmers have grown these and similar varieties under the impression that they would secure the same feeding value, ton for ton, as ordinary turnips. Hence, it is more accurate to adopt this modified classification, under which the group called soft turnips includes some yellows as well as the whites.

According to Sanders, the starch equivalent per 100 lb. of swedes may range between 5·1 and 7·3 on the basis determined by the late T. B. Wood, viz., that the starch equivalent of swedes is, approximately, 63 per cent. of the dry matter content. Examples cited by Sanders, from which the range of variation is calculated, were :—Swedes grown in Norfolk, 9·4 per cent. dry matter ; swedes grown in the Fens, 8·1 per cent. dry matter ; and Kellner's figure for German swedes, 11·5 per cent. dry matter. The dry matter content, however, varies not only with the district in which the roots are grown, but is affected by local influences of season and soil. For example, at Cockle Park, in 1904, the average dry matter content of the swedes grown was 14·96 per cent., whereas in 1921 the figure was 10·24 per cent. This meant that 20 cwt. of swedes in 1904 had as much dry food material as 29¼ cwt. in 1921. In terms of starch equivalent, 50 lb. of swedes from the 1904 crop supplied 4·71 lb. S.E., whereas only 3·22 lb. S.E. was obtained from the same quantity of swedes in the 1921 crop.

The dry matter content of the root crop is also influenced by

the variety or varieties grown. In 1929, in the trials at Cockle Park, varieties of swedes showed a range in dry matter content of 2·43 to 3·17 per cent., and turnips of 1·57 to 2·26 per cent., although grown under the same conditions of climate, soil and manurial treatment. It is generally assumed that generous manurial treatment, especially with phosphates, has a beneficial effect upon the feeding value of roots, although there is room for more exact investigation of this matter.

Straw.—The composition and nutritive value of oat straw, which is chiefly used for feeding, varies with the district in which it is produced and, more particularly, with the stage of maturity at which it is cut. In addition, the variety of oat is not without significance in assessing the value of the straw for feeding, especially in relation to its palatability and digestibility. With cattle on a ration of oat straw and turnips, the better feeding results obtained in the north, as compared with the south of the kingdom, is well known in practice; and this, in large measure, is due to the marked superiority of north-country straw in protein content.

In investigations carried out some years ago, by Collins and Thomas, on the sugars and albuminoids of oat straw, the variation for the sugar in the samples examined ranged from 0·33 to 9·74 per cent., while for the albuminoids the range was from 1·12 to 8·05 per cent.—variations great enough to explain wide differences in feeding value. Manurial treatment, district and harvest conditions, according to these investigators, were the more important influences, although their general impression, resulting from these experiments, was that "good husbandry" often accounted for feeding with oat straw and swedes being more successful in some districts than others. In this connexion, the maturity of the crop when harvested is of vital importance, for, in general, it may be said that the more completely the seed has ripened, the more thoroughly will the straw be exhausted of the most valuable nutritive material, and the harder and also more difficult it will become to masticate. From examination of the figures given by Collins and Thomas, it is evident that good oat straw has a higher feeding value than inferior hay.

In a more recent investigation, in Wales, into the chemical composition of barley grain and straw, this variation in feeding value was clearly indicated. It was shown that soil, altitude and the variety grown affect the percentage of the different constituents in both grain and straw. In the case of the straw the percentage of the various constituents varied within wider limits

than in the case of the grain; although even in the samples of grain examined there was a difference of as much as 40 per cent. between the minimum and maximum percentages of albuminoids or protein content.

Hay.—The variation in hay is influenced by type of herbage, manurial treatment, time of cutting, season, &c. According to Wood's figures, the following are typical analyses:—

	Protein Content	*Starch Equivalent*
Meadow hay (medium) ..	4·6	31
Seeds hay	4·9	24

The variation for meadow hay, however, may be anything between 20 and 40 for starch equivalent, and the digestible protein between 3·5 and 9.

The writer is inclined to think that seeds hay grown in the north of England and in Scotland possesses a higher average feeding value than is indicated by the figures given above. From analyses made in the Agricultural Department of Armstrong College it would appear also that 4½ lb. of seeds hay have about the same feeding value as 5 lb. of meadow hay. Variation in both types of hay is influenced in part by the proportion of clover present. This is clearly shown in figures given by the late T. B. Wood in an article, "Chemical Composition of Pasture Plants and Hay," from which the following is an extract:—

"There is, however, a very notable difference in composition between hay made from grasses and from leguminous plants. Average figures are given in the following table:—

PERCENTAGE COMPOSITION OF HAY MADE FROM GRASSES AND LEGUMINOUS PLANTS

	Grasses	*Leguminous Plants*
Protein	10	15
Fat	3	3
Carbohydrates ..	38	33
Fibre	28	26
Ash	7	7
Water	14	16
	100	100

DIGESTIBLE NUTRIENTS PER CENT. IN HAY MADE FROM GRASSES AND LEGUMINOUS PLANTS

	Grasses	*Leguminous Plants*
Protein	5	10
Fat	1	1·5
Carbohydrates ..	22	23
Fibre	15	12

"Average samples of meadow hay will approximate closely in percentage composition, and in content of digestible nutrients

to the figures given above for hay made from grasses. This is because the percentage of leguminous plants in average samples of meadow hay is too small to cause an appreciable departure from the composition of grasses. In the case of hay made from meadows manured with basic slag, or from meadows whose herbage for any other reason contains over an average percentage of Leguminosae, the percentages of total and digestible protein will be appreciably higher."

As showing the effect of manurial treatment of old land hay, more especially with phosphates, on feeding value, the results from the Palace Leas old meadow plots at Cockle Park may be cited. These plots have been systematically treated for 32 years, and the hay cut from each plot has been weighed each year. In addition, the hays from the different plots were tested some years ago for feeding quality both by chemical examination in the laboratory and by feeding trials with sheep. When the hay from the unmanured plot is valued at 80s. per ton, that from the plot receiving an annual dressing of basic slag (in the light of the examination mentioned) is worth 93s. per ton, whilst that from the plot receiving basic slag and muriate of potash is worth 101s. 9d. per ton. This valuation is based mainly on the percentage of protein and carbohydrate constituents, determined by chemical analysis, correlated with the live weight returns from the experimental pens of sheep fed on the different lots.

Further, it should be noted that later research, notably that at the Rowett Institute, Aberdeen, has shown that there is an increased mineral content in judiciously manured herbage. Well-manured pastures or hayfields produce herbage with a high mineral content, partly through the enrichment such manuring gives to individual plants and partly through the growth and spread of plants naturally richer in minerals. Well-treated meadow hay fields are calculated, therefore, to yield hay rich in bone-forming material as well as in protein and the other food constituents.

The time or stage of cutting has also a marked effect upon the quality of the hay, whether new or old land. Warrington, in his *Chemistry of the Farm*, states that hay harvested before it comes into flower contains 17·7 per cent. of nitrogenous substances; if allowed to reach the stage at which normally cut, the figure is 11·2 per cent., and when fully ripe the percentage is only 8·5. The work done at Cambridge and elsewhere, in recent years, has shown that young grass is richer in protein than that allowed to mature and has, moreover, a higher digestibility percentage.

General Conclusions.—(1) From the foregoing observations, it is fair to deduce that strict accuracy in the framing of rations on the present basis is impossible, on account of the variation occurring in the food value of the home-grown foods which form so large a proportion of the rations fed to live stock. Fair accuracy is only possible if more account is taken of the variation in composition of home-grown foods from locality to locality and farm to farm.

(2) It is not practicable to secure chemical analyses showing the composition of the home-grown foodstuffs for each particular case, *i.e.*, before suggesting suitable rations for a farmer's live stock. At the same time, the approximate quality of these should be judged if possible, and the conclusion arrived at taken into account when making up the rations. In many cases, this is now being done, more particularly in the case of hay. In the past, bulk consideration alone received attention, but it is obvious that the quality of such foods should not be neglected when framing balanced rations, even though the determination of such quality is based upon estimate.

(3) More research is needed into the composition of our home-grown foods, the variation in these, and the causes of such variation. Until such research is carried out, the results of comparative tests of feeding rations, carried out at different centres in the country, can only have a very limited value and application.

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CONTROL OF THE MEADOW FOXTAIL MIDGES

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Necessity for Control.—Three species of gall midges,* belonging to the family of Cecidomyidæ, lay their eggs in the flower heads of meadow foxtail grass (*Alopecurus pratensis*). These midges are minute red or yellow gnat-like flies. The grubs, resulting from the eggs, feed on the seed or seed-producing parts of the flowers and prevent seed formation. Enormous numbers of grubs are frequently present in the grass heads. For example, in one Aberdeen sample, collected July 25, 1928, by Dr. G. D. Morison, under 4 per cent. of the florets contained seeds, while the remainder either contained or had contained grubs. Again, over 21,000 grubs of one species alone were obtained from 120 heads of grass collected in Dorset, June 26, 1929, by Mr. L. B. Hall. These grubs do not lower the quality of the grass grown for hay or pasture purposes, but if a seed crop is required control is an absolute necessity.

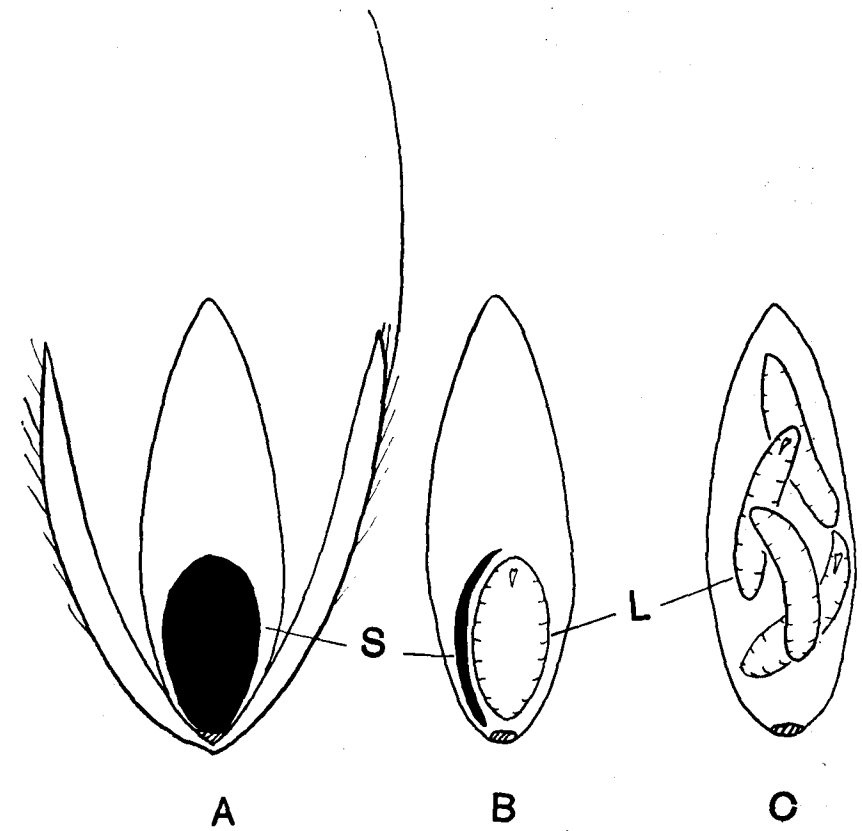
Distribution.—As far back as 1885, Miss Ormerod realized that there were two kinds of midges the grubs of which prevented seeding of this grass in Cheshire, but it was not till 1895 that Reuter described one of these species (*D. alopecuri*) as well as a third one (*S. geniculati*). The writer described the second of Miss Ormerod's species (*C. merceri*) in 1930.

In a recent survey, made between 1926 and 1929, all three species were found to occur in almost every county of England, as well as widely throughout Wales, Scotland and Ireland. The midges are also to be found in Finland, Denmark and New Zealand, having undoubtedly been accidentally introduced into the last-named country in seed imported from Europe.

Food Plant and Nature of Injury.—Meadow Foxtail grass (*Alopecurus pratensis*) is undoubtedly the most usual food plant, and, so far as is known at present, the only one of two of the midges. The other midge (*S. geniculati*) also attacks Marsh or Floating Foxtail grass (*Alopecurus geniculatus*).

The midges are injurious only in the grub stage, and although, in the case of two species, one grub destroys only one seed and, in the case of the other species, one or more grubs are necessary to prevent one seed forming, yet these grubs are often present in such enormous numbers that very serious losses to seed crops result. All the three kinds of grubs damage the seed-producing parts of the flower.

* *Dasyneura alopecuri* Reuter, *Stenodiplosis geniculati* Reuter and *Contarinia merceri* Barnes. For further detailed information concerning these midges reference may be made to *Ann. Appl. Biol.*, XVII, 2, May, 1930.



Diagrammatic representation of A, Meadow Foxtail grass floret containing half developed seed (S); B, floret attacked by grub of either *D. alopecuri* or *S. geniculati* showing the grub (L), which will stay in this position till the following spring, and the remains of the seed (S); C, floret attacked by grubs (L) of *C. merceri*—the grubs are full grown and ready to jump to the ground.

Seasonal History in Great Britain.—During the winter, two of the three kinds of grubs are to be found in the seed cases that have dropped to the ground, while the third remains in the soil. All three are full-grown grubs merely awaiting the return of spring when they change into pupæ. The adult midges then soon emerge.

The midges of *D. alopecuri*, the females of which have red bodies, start emerging at the end of April and continue until very early July, but the greater number have emerged by the end of the second week in June. The grubs grow in

size for about seven weeks, and then remain in the seed cases until the following spring. Normally, this species has only one brood a year, although sometimes a few midges of a second generation may emerge in early August.

S. geniculati has two broods a year. The spring brood midges emerge in April and May, the resulting grubs feeding up very quickly; while the midges of the second generation are on the wing from June to August. The bodies of the female midges of the summer brood are bright red, while those of the spring brood are much more sombre in appearance. The date of appearance of the summer brood varies very considerably with the locality, being earlier in the southern and western areas than in the northern and eastern ones. The grubs of this species also remain in the seed cases till they emerge as midges either in the summer or following spring.

C. merceri usually has only one brood of flies a year, and this emerges from May to July, but occasionally a partial second brood appears during the period August to October. In the case of this midge, the grubs feed and grow up to full size very rapidly in from three to five weeks. Then, after a shower of rain, they crawl out of the empty seed cases and spring into the air, falling to the soil, in which they spend the rest of the summer, autumn and winter. The bodies of the females of this species are bright yellow.

The grubs of the three species may be very easily distinguished; those of *D. alopecuri* are orange to brick-red in colour, those of *S. geniculati* pale buff to salmon pink, and those of *C. merceri* bright golden yellow. As a rule only one grub of *D. alopecuri* or *S. geniculati* is to be found in one floret, and very often a crescent-shaped piece of the destroyed seed is found with them. On the other hand, up to 15 grubs of *C. merceri* can be found in one floret, and in the case of this species no trace of the seed remains, the explanation being that these grubs prevent the seed forming, whereas the two other kinds destroy the seed when it has formed. Subsequent to the migration of the grubs of *C. merceri* to the soil, the foxtail head seems to consist of "blind" florets and this is all that appears on the seed testers' tables. On the other hand, evidence of the other two midges is at once seen by the presence of the grubs.

Control Measures.—The only method of controlling these midges when they have become established is to prevent the grass from flowering until the bulk of the midges have

emerged. This may be done either by allowing sheep to graze on the grass or by rough cutting it; then allowing the grass to flower and seed in the normal way. The date for closing down the field must be varied to suit the locality and be based upon biological observations. In localities where such observations have not yet been made, a trial and error method of cutting the grass up to certain dates, based on those used in the trial at Rothamsted, should be adopted. This method of control was tried successfully at Rothamsted in 1929. Plots of grass were cut at different dates and then closed down and allowed to mature, control plots, which were not cut at all, being also kept. The result was that the control plots had 80 per cent. of the seed destroyed, plots cut until April 29 had 44 per cent. destroyed, while plots cut until May 13 had only 11 per cent. of the seed destroyed. Care must be taken that cutting or grazing the grass is not continued too long, or the grass will not flower and produce seeds.

If the midges are not established in the area in which it is proposed to grow the grass for seed, care must be taken to sow seed free from midges. This can be done either by dry heating the seed for 35 minutes to a temperature of 59°-60° C.; or by treatment with carbon bisulphide (1 gr. CS_2 to a litre of air) in a sealed room for nine hours; or, although this treatment is less certain, by keeping the seed over for a year.

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MARKETING NOTES

National Mark Eggs.—An unusual increase in supplies of home-produced eggs was reported at the end of August; this was accompanied by a pronounced falling off in the demand in London, which was probably due in some measure to the absence of consumers on holiday. The result was a temporary slump in prices in the London markets, which, however, was soon succeeded by a reassuring firmness. One feature of the operations of the accredited agents of National Mark Egg Central, Ltd., has been a resumption of the former good demand for National Mark eggs of "Special Weight" grade.

During the six months, March to August, 1930, the authorized packing stations sold 132 million eggs, of which 94 million were consigned under National Mark labels.

National Mark Beef.—The number of sides (including quarters and pieces in terms of sides) of beef graded and

marked with the National Mark for the five weeks ended September 20 was as follows :—

Week ended		*Select*	*Prime*	*Good*	*Total*
			LONDON		
August	23 ..	542	910	50	1,502
,,	30 ..	412	933	36	1,381
September	6 ..	308	761	34	1,103
,,	13	685	942	24	1,651
,,	20 ..	643	1,085	41	1,769
			BIRKENHEAD*		
August	23 ..	68	367	—	435
,,	30 ..	31	484	14	529
September	6 ..	20	356	4	380
,,	13 ..	110	496	2	608
,,	20 ..	148	645	—	793
			SCOTLAND*		
August	23 ..	1,966	587	—	2,553
,,	30 ..	1,633	493	—	2,126
September	6 ..	1,720	578	—	2,298
,,	13 ..	1,816	567	—	2,383
,,	20 ..	1,916	652	—	2,568
			TOTAL LONDON SUPPLIES (*All Sources*)		
August	23 ..	2,576	1,864	50	4,490
,,	30 ..	2,076	1,910	50	4,036
September	6 ..	2,048	1,695	38	3,781
,,	13 ..	2,611	2,005	26	4,642
,,	20 ..	2,707	2,382	41	5,130
			BIRMINGHAM		
August	23 ..	44	127	3	174
,,	30 ..	15	116	8	139
September	6 ..	18	126	15	159
,,	13 ..	21	146	20	187
,,	20 ..	18	164	10	192

* Sides consigned to London.

The hot weather in the early part of September was naturally prejudicial to the sale of beef, but the trade revived in a satisfactory manner and the demand for National Mark beef remained firm. Hostile critics of the scheme have at times stated that there was no public demand for National Mark beef. It is difficult to prove the extent to which the public is asking for the beef in various districts, but an interesting sidelight is thrown on the subject by the visit of an Inspector to two shops in a London suburb early in September. In one shop, out of 14 customers who came to buy home-killed beef, 10 of their own accord especially asked for National Mark beef, while in the other shop, out of 17 customers, 15 asked for National Mark beef. Such figures indicate that housewives are realizing the advantages of being able to purchase a graded and guaranteed article, and now take the initiative in asking for it.

The situation in Birmingham has not changed during the past five weeks to an extent that reveals itself markedly in figures, but it is to be noted that the number of sides marked, 174, in the week ended August 23 was the highest recorded since June 1, and there are indications of the development of a more favourable attitude to the scheme within the meat trade.

National Mark Apples and Pears.—Although, as indicated in Marketing Notes in the August issue of this JOURNAL, the apple crop this year will not be so heavy as usual, the decreased quantity, which is largely confined to low-grade fruit, is to some extent compensated by an improvement in quality.

Covent Garden Market has already provided an instance of the popularity of National Mark apples. A recent display of fruit packed under the Mark was staged by a well-known wholesaler, with the result that he had considerable difficulty in meeting the demands of his customers.

National Mark Canned Fruit, Peas and Beans.—During September, supplies of National Mark canned fruit and vegetables were released for sale, and are now available in retail establishments all over the country. The Ministry has issued large supplies of an attractive show-card and window strip to authorized canners for distribution to retailers handling their products, and further publicity for National Mark canned produce is being given in the private advertisements of authorized canners and distributors. A good demand for National Mark canned produce is anticipated.

National Mark Dressed Poultry.—The authorized packers who are operating in this scheme report that there is a growing demand for National Mark poultry, and that they have some difficulty in meeting it. This state of affairs speaks well for the National Mark supplies that have so far been marketed, and although the scheme is at present only effective within a limited sphere a gradual development may be anticipated.

Publicity for National Mark Produce.—Four National Mark Weeks were held in September, viz., at Hereford (Sept. 5-11), Bedford (Sept. 22-27), Bradford (Sept. 24-Oct. 4) and Watford (Sept. 29-Oct. 4). The Hereford Week was organized to take advantage of the excellent opportunity to advertise the National Mark afforded by the Three Choirs Festival, which brought a large number of visitors to the City ; an exhibition

of National Mark commodities was staged at the Shire Hall. At Bedford and Watford, exhibitions were staged at premises temporarily acquired for the purpose, while at Bradford a display was staged at the Third Annual Home, Industry and Fashion Exhibition which was held concurrently with the National Mark Week.

An interesting innovation in the way of advertising National Mark products is a National Mark Demonstration Motor Van, which is being run on a series of three tours in certain parts of Scotland under the auspices of the Department of Agriculture for Scotland. The first tour, which commenced on August 20, will embrace a number of holiday resorts, where it will be possible to bring National Mark products prominently before large numbers of tourists. The remaining two tours, which are to be conducted in October and early in the new year, will cover the larger towns. Small consignments of certain English National Mark commodities are being carried and displayed on the van. Samples will be sold to the public and the van will be decorated with some of the attractive display material which is supplied to retailers of National Mark commodities. Leaflets explaining the different National Mark schemes will also be distributed, and lists of the authorized packers in the schemes will be available for retailers so that they may be in a position to follow up the visit of the Demonstration Van by obtaining supplies.

The advertising of National Mark beef in Birmingham newspapers was continued throughout the month. On September 11, Mr. Ben Riley, M.P., addressed the Birmingham Labour Party with special reference to the National Mark beef scheme. A large number of women's organizations throughout Birmingham will be addressed by trained women speakers during coming months on the National Mark beef scheme from the woman's standpoint.

Displays of Home Produce.—Displays of home produce (including some National Mark commodities) have recently been staged at the International Bakers' and Confectioners' Exhibition (Sept. 6-12) and at the International Grocers' Exhibition (Sept. 20-26), both held at the Agricultural Hall, Islington. The accommodation provided by the Empire Marketing Board at these Exhibitions allowed of an exhibit entirely different from that normally arranged. The central feature consisted of a sample room for the "Trade" only, modelled somewhat on the lines of a Trade Exchange, with sufficient space for displaying samples and interviewing

traders; a Traders' Club was available for the use of trade visitors. Only a limited amount of space was devoted to the display windows seen by the general public.

South Africa—Dairy Industry Control Act, 1930.—The main provisions of this Act are as follows:—

A Board of Control, incorporated under the Act, is established for the dairy industry, consisting of six milk producers, five creamery and cheese factory owners, two farm dairy buttermakers, and one representative of cheese and butter distributors; the Chairman of the Council is to be an officer of the public service, but the remaining members are to be nominated by their respective industries.

The general functions of the Board are to co-ordinate the primary production, manufacture and marketing of dairy produce, to take measures to stabilize prices of dairy produce in the Union and generally to advise the Minister of Agriculture on all matters relating to the development of the dairy industry.

The Board's powers are wide. It may issue regulations governing export, may determine the minimum exportable quantities, and may assume control over produce intended for export. It can demand information from butter and cheese manufacturers and from warehousemen. In certain circumstances, it may also fix the minimum price to be paid to the producer for milk and cream.

The Board may also impose a levy on all butter, butter substitutes and cheese manufactured in or imported into the Union, which may be utilized:—

(*a*) in paying an export bounty on butter and cheese;
(*b*) in stimulating the consumption of dairy produce;
(*c*) in providing marketing credit;
(*d*) in general measures to develop the dairy industry.

The Act, which is subsidiary to the Dairy Industry Acts, 1918-1926, also provides for such varied matters as compulsory marking and grading, compulsory purchase of milk by unit of butter-fat, the limitation in number of creameries and milk factories and the prohibition, in certain circumstances, both of the import and export of milk products. The powers under this paragraph are, however, exercised by the Government and not by the Board, though the latter is expected to advise the Minister on his exercise of certain of them.

The Act, which is rather long, is a striking mixture of two principles, regulation by the State and regulation by the industry. The application of the latter principle by the Control Board will be watched with interest.

South Africa—Agricultural Warehouse Act, 1930.—The object of this Act is to provide a system of licensed warehouses as a basis for the issue of negotiable warehouse receipts against agricultural produce in store. The form of warehouse receipt is prescribed by the Act. Such receipts are negotiable instruments against which the Land and Agricultural Bank of South Africa and the South African Reserve Bank are empowered to make advances; they may be endorsed by the holder for the purpose of conveyance of ownership or for deposit as collateral security. In the case of the Land Bank, receipts must be presented by any bank or co-operative society or company or by a credit society or loan bank under the Agricultural Credit Act, 1926. In the case of the South African Reserve Bank, receipts must be presented by any bank or by the Land Bank, and advances on such warehouse receipts may only be made up to 20 per cent. of its discounts. Provision is made for preserving in the store the identity of each parcel of produce covered by a warehouse receipt.

"Rail-surety-notes" may also be issued by the railway, port and harbour authority in respect of grain received for conveyance to a harbour for export—unless a warehouse receipt has already been issued for it—and such rail-surety-notes are equivalent to warehouse receipts, in so far as their use as collateral security is concerned.

Security must be lodged with the Minister of Agriculture in respect of every licensed warehouse in accordance with a monetary scale based on the maximum value of produce stored in the warehouse at any time during the currency of the previous licence. In the case of a new warehouse, the security required is £1,000. Before a licence is issued or renewed, the deposit of a fire insurance policy, for an amount not less than the security, may also be required. The nature, situation, construction and equipment of warehouses may be prescribed by regulations so as to ensure efficient and safe storage of produce deposited therein.

Warehousemen are bound to accept for storage any produce, of the kinds which they are entitled to store, that may be presented for storage, provided space is available.

The keeping of complete records by warehousemen, and the inspection of warehouses and records by the Minister of Agriculture, are provided for. A register of licensed warehouses, showing the location, capacity and kinds of produce which may be stored therein has to be kept by the Minister of Agriculture.

The Apple Industry of Nova Scotia.—The Royal Commission on the Apple Industry of Nova Scotia, appointed in February of this year, has recently submitted its report. The Commission expresses its belief that the principal need of the industry is the establishment of highly centralized control over the marketing of Nova Scotian apples by a single organization, which would act as a strong business executive for the industry, leaving growers free to devote their whole attention to the production of fruit. The Commission emphasizes the need for unanimous support of such an organization by fruit growers, and refers to the compulsion which, in certain countries, has been applied to recalcitrant growers where the majority desired to adopt an improved marketing system.

The recommendations of the Commission cover two main aspects of fruit marketing, viz.:—(1) the preparation of fruit for market, and (2) marketing organization.

(1) With a view to improving the condition in which Nova Scotian fruit comes on to the market, the Commission recommends compulsory inspection of all fruit, whether for Canadian consumption or export, and the taking of measures to ensure more uniform interpretation and more rigid observance of the existing fruit-grading regulations. Greater standardization of packages for apples, particularly for export, is also recommended. Other recommendations suggest certain forms of educational aid in fruit-growing technique and compulsory spraying of badly infested orchards.

(2) With the object of ensuring the centralized control of marketing, which is regarded as essential, the Commission recommends the creation of a new marketing organization, which might be known as the Consolidated Fruit Company of Nova Scotia, which should be empowered to acquire all the various existing fruit-marketing companies, the United Fruit Companies and such other organizations as might desire to become part of the new organization. Membership would be open to all fruit growers in the Annapolis Valley. Such an organization should not be brought into operation, however, until growers representing 50 per cent. of the apple crop of the Valley show themselves in favour of it.

The objects of such an organization would include the co-operative marketing of its members' apples and the maintenance of an agency in Great Britain; the co-operative manufacture and marketing of fruit products; the purchase of requisites for the fruit industry; the dissemination of information relative to the industry; and the provision of financial assistance for fruit growers.

The Company would be empowered to make deductions from the proceeds of sales of fruit in order to cover its operative costs and to build up an adequate reserve. A suitable trade-mark would be registered for its sole use.

It is recommended that the Company should receive State assistance in the form of a guarantee of its loan capital, raised for the purposes of acquiring the necessary fixed assets and of financing its members by means both of long-term loans and of temporary advances on fruit sold through the Company.

The compulsory pooling of prices received for fruit produced in any district covered by the Company's operations, provided 75 per cent. of the members in that district vote in favour of pooling, is also recommended.

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OCTOBER ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,
Director of Agriculture for West Sussex.

Root Crops.—The period of lifting and storing root crops is now at hand. It is a great advantage to get potatoes into the clamp or pit in a fairly dry condition. Protection from light should be given as soon as possible, although exposure to a dry wind will be advantageous. Adequate ventilation is no less important than protection from frost, and the apex of the pit should be made to allow ample ventilation for a few weeks after storing.

Mangolds continue to grow during autumn, and lifting is usually delayed as long as it is considered safe to do so either from the point of view of interference by frost or from wetness in the land making carting difficult. Mangolds are still immature when lifted and changes go on in the clamp, so that ventilation should be attended to. Mangolds that are put direct into a root house under cover should be stored in a wet condition, and even in outside clamps the roots lifted in wet weather keep better than those lifted under very dry conditions.

Sugar beet is usually carted from the field to rail or factory without any storage. The tops and crowns of sugar beet are an important source of stock food. Wilting for about ten days is advisable before they are folded or carted off. When fed to cattle the quantity should be limited for the first few days and gradually raised to about 70 lb. per head per diem; there is often a tendency to overfeed with beet tops, a wasteful and injurious practice.

Seed Dressing.—The dressing of seed to destroy fungus spores which may be carried by the seed should not be neglected. It is common knowledge that very large losses are sustained annually in this country from attacks of parasitic fungi. The full extent of this damage may not be fully recognized even by scientific workers, still less by practical farmers who may have attributed crop failures, either partial or complete, to insect attacks or adverse conditions of soil or weather, whereas the real reason may be a fungus attack. Certain diseases such as Loose Smut of wheat and barley are carried in the seed itself and are not destroyed by surface contact dressings. In consequence it is important that the crop from which seed wheat or barley is selected should be free from these loose smuts.

Diseases such as Bunt in wheat, commonly called "Smut" or "Stinking Smut," are well known to wheat growers, and dressing the seed against this disease is widely practised. There are many proprietary dressings on the market, some designed to control Bunt only, while others combine a dressing to make the seed objectionable to birds. Copper sulphate is widely used and formalin has been much favoured. The essentials of a seed dressing are that it should be cheap, easy to use, effective in controlling disease, not injurious to the germination of the seed, and not producing a sticky condition which would interfere with drilling or sowing.

It is recognized that liquid dressings do not fulfil all these conditions. The use of a dry dressing which would control the disease is desirable. During the last few years copper carbonate ground to a very fine powder has been used with considerable success. About 2 oz. of copper carbonate are incorporated with a bushel of grain. The mixing requires to be well done and is best performed in an airtight chamber; a barrel with a spindle through it to enable it to be revolved is suitable, but special dusting machines are available. The worker should be protected from the dry dust, which is injurious if inhaled.

A proprietary substance, which can be applied in the same way, was used with success by D. G. O'Brien and E. G. Prentice in their experiments on the control of Leaf Stripe or Yellow Leaf in Oats (reported in the *Scottish Journal of Agriculture*, July, 1930). These experimenters obtained remarkable control and were able to reduce the disease to a negligible amount. It is possible that the practice of dry dressing will increase and may entirely supersede the wet dressings; seed merchants

may find it advantageous to supply dressed seed. For those who cannot get dry dressed seed and do not care to do it themselves, the formalin treatment can be recommended. The procedure is to heap the grain on a clean floor and sprinkle it with weak formalin (1 pint of commercial formalin to 40 gallons of water, or ½ fluid ounce per gallon) at the rate of about 1½ gallons per sack of grain. The grain is turned over until completely wetted and should then be heaped up and covered with sacks, which have also been moistened with weak formalin, for four hours. The grain is then spread out and allowed to dry, after which it should be sown as soon as possible. (An article on dry pickling of seed wheat to prevent Bunt appeared in the issue of this JOURNAL for August, 1930, p. 429.)

Stock in Autumn.—Pastures full of grass may be an inducement to leave young cattle out when it is inadvisable to do so. Many young cattle are spoiled every autumn by being left out too long on the pastures without supplementary feeding. It is at this season that parasitic troubles are most manifest. Hoose or husk is frequently found in young cattle under one year old. Where pastures are heavily stocked and closely grazed it is not infrequent for attacks of this trouble to be apparent as early as July, but there is more trouble during the later months. As soon as the disease is apparent steps should be taken to prevent a severe attack, and nursing of the affected animals is necessary. The stock should be moved to a fresh pasture if possible, and should be housed at night and fed with good hay and a few oats and linseed cake. Animals severely attacked should be treated by a veterinary surgeon.

Another disease which accounts for losses in young cattle is what is known to veterinary surgeons as parasitic gastritis. The disease is due to a mass infection of minute parasitic worms in the digestive system of the animal. Any undue wastage or loss of condition should not be neglected, and if accompanied by scouring the condition is serious.

Sheep are subject also to the same disease: the "Lincolnshire Lamb Disease," "Drying," "Double Scaup," or the general description "the worm," are all parasitic gastritis. Infested land, heavy stocking and close grazing are contributing factors. When the attack is slight a change to clean pastures, giving the stock a comparatively large range, will often prove a remedy. Affected cattle should be housed and well cared for. An article on the control of nematode parasites of sheep appears at p. 681 of this issue.

Liver Fluke.—A lookout should now be kept for attacks of this parasite. Sheep are the usual sufferers, but cattle are often attacked, as also may be rabbits.

The full life history of the fluke, including the part played by the fresh water snails, has been carefully observed. The young fluke, which is enclosed in a very small case or shell, is taken into the animal with grass or water. The fluke is liberated in the intestine; it bores through the wall and ultimately reaches the liver. Wet cloudy summers are favourable to the flukes and this means increased infection. The course of the disease depends on the extent of the infection. Mass infection may bring about the death of the sheep rather rapidly and without much loss of condition. Such cases are difficult, as little success has attended attempts to kill flukes newly picked up.

(Parasitic worms and live fluke in sheep are both dealt with fully in Bulletin No. 1 (*Some Diseases of Farm Animals*), a copy of which may be obtained from the Ministry, post free, for 1s. 6d.).

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NOTES ON MANURES

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Observations on the Rothamsted Plots.—It may be of interest to put on record some of the more striking features of the field experiments at Rothamsted which have attracted the attention of visitors during the past season.

Wheat.—The greatest contrast on the farm has again been provided by the Broadbalk plots which demonstrate the marvellous increase in fertility resulting from a bare fallow. This year it has been possible to observe the classical series of manurial treatments on continuous wheat on the one hand, and on the first wheat crop after no less than four successive years of bare fallow on the other. The continuous wheat, which was in fact the third crop after two years fallow, presented the normal appearance of Broadbalk field, the dunged plot and those receiving full manurial treatment being fairly good crops although slightly lodged this year, while the unmanured plot and those without nitrogen were exceedingly short, thin and poor. All plots after the long fallow produced heavy crops which were exceedingly badly lodged where any nitrogen had been given and considerably twisted even on unmanured land or on land receiving no nitrogen. The crop

after fallow on the soil which had received no manuring since 1839 did not appear to be much inferior to that on the dunged land under continuous cropping; while even the crops which had received heavy nitrogenous manuring had been put into quite a different class by the effects of the fallow. The result of two years of bare fallow in these plots was seen in 1928 when very heavy crops of wheat were produced, which in that favourable season stood up well. Everything goes to show the increase in fertility resulting from thorough cultivation, and it is reasonable to assume that the same effects are produced in minor degree by good cultivation carried out within the limits imposed by ordinary systems of cropping.

A set of four wheat varieties, Squarehead's Master, Swedish Iron, Million III and Yeoman II, were to be seen on one series of plots which had received 2 cwt. of sulphate of ammonia or its equivalent applied in two dressings, half in March and the remainder in May. In spring the plant was rather thin and stood well in spite of the rough and showery weather in July and early August. The land was in medium condition, and the indication was that 1 cwt. dressing, common in practice, might under certain circumstances be increased.

Barley.—On the Great Hoos permanent barley plots the well-known effect of superphosphate in promoting early maturity was particularly striking this year, and farmers had difficulty in believing that the sections with and without phosphate had been drilled on the same day. The effect on barley of the omission of potash is not usually marked on the clay soil at Rothamsted: the yield over a 76-year period being 39·3 bushels with complete manure and 35·8 bushels where potash is continually withheld. This season, the lack of potash was noticeable by a distinct tendency to lodge, whereas the completely treated barley was standing well, this being in harmony with the commonly-held view that potash tends to improve the straw of cereals.

A new rotation experiment has been set out on Hoos field, on a section which had been cropped with cereals for several years and received only nitrogenous manures. It was noticeable that the effect of phosphate in promoting maturity of barley was much more evident on the plots receiving superphosphate than on those receiving the same amount of phosphate in the form of finely-ground North African rock, indicating that the former was most active in the first year. The arrangement of the experiment permits of the residual effects of each of these manures to be followed out in a series of crops.

Seeds.—In another section of the same experiment heavy dressings of nitrogenous manures had been applied to first-year seeds and had produced big crops of hay; the effects of these dressings in promoting growth in the aftermath were very striking, although the proportion of clover in the herbage was less than in the untreated plots.

Forage Crops.—Where a series of mixtures of leguminous and cereal mixtures had been treated with various combinations of nitrogenous and mineral manures, the effect of the former in stimulating the cereals and the latter in helping on the leguminous plants was most marked. It remains to be seen whether protein will have been secured more economically by minerals or by nitrogen or by a judicious combination of the two. Possibly the extra carbohydrate produced on the plots receiving nitrogen will be the deciding factor.

Ammonium Phosphate.—Superphosphate was the first water-soluble phosphate made for agricultural use. First prepared on a small scale for use on the Rothamsted farm in 1840, it is now manufactured in enormous quantities, about 670,000 tons being used in England in 1928 when the world output approximated to 15 million tons. Superphosphate, however, contains about half its weight of gypsum, which is of comparatively little fertilizing value and serves to dilute the main constituent. In regions where manures have to be carried long distances, the need has been felt for some form of available phosphate of a more concentrated nature than ordinary superphosphate. This situation was first met by the introduction of so-called double superphosphate, which contains the same water-soluble compound of phosphoric acid (mono-calcium phosphate) as exists in ordinary superphosphate, but in this case without the gypsum. By this means the grade of the product is increased from about 16 to 40-50 per cent. of water-soluble phosphoric acid. This product is extensively made in the United States for economy in transport and handling on the farm. In both types of superphosphate, calcium is the base which is combined with the phosphoric acid, and sulphuric acid is consumed in the manufacturing processes, gypsum being made in both cases, but only appearing in the final product in ordinary superphosphate.

More recently improvements have been made in the manufacture of phosphoric acid from phosphate rock, and by combining the phosphoric acid with synthetic ammonia various phosphates of ammonia are produced which contain

water-soluble phosphoric acid in high concentration and also a considerable amount of available nitrogen. Two ammonium phosphates have been used for fertilizer purposes. Mono-ammonium phosphate, when pure, contains 61·7 per cent. of phosphoric acid and 12·2 per cent. of nitrogen, while di-ammonium phosphate has 53·8 per cent. and 21·2 per cent. respectively. Both are white crystalline substances and carry no combined water.

A further possibility is the preparation of potassium phosphate providing a concentrated source of potash and water-soluble phosphate. This substance contains, when pure, about 54 per cent. of potash and 41 per cent. of phosphoric acid.

A few experiments are already on record comparing the phosphates of ammonium and potassium (or mixtures containing the phosphate in these forms) with equivalent mixtures containing the phosphate as superphosphate. Thus, at Rothamsted in 1927, the following results were obtained with swedes :—

	Tons per acre	
	Roots	Tops
Superphosphate and sulphate of ammonia	14·99	5·28
Mono-ammonium phosphate equivalent	15·19	5·23
Standard error	·22	·12

At Woburn in 1928 the yields of potatoes in a comparative experiment were :—

	Tons per acre
Complete fertilizer containing di-ammonium phosphate ..	13·0
Equivalent artificials containing superphosphate	13·8
Standard error	·33
Potassium phosphate (no nitrogen)	11·9
Equivalent potash and superphosphate..	12·05
Standard error	·33

A difference exceeding three times the standard error may be regarded as a real one, *i.e.*, not due to accidental causes. In all the above comparisons, the differences do not reach this magnitude, and we may therefore say that these experiments bring out no difference in action between the forms of phosphate used. A good deal of further information with regard to these substances will, no doubt, shortly be forthcoming.

When to Apply Manures.—The broad lines with regard to the time of application of manures were indicated by the results of the early analyses of the drainage water from the wheat plots receiving different combinations of fertilizers at Rothamsted. It was found that very little phosphate or

potash appeared in the drainage even when large application of these manures had been made for a long series of years, whereas the loss of nitrogen and of lime was considerable. It was further found that the autumn application of sulphate of ammonia resulted in abnormally high losses compared with those suffered by spring dressings. The loss of lime, though not so serious as the wastage of nitrate because it is cheaper to replace, was greatest from plots receiving heavy and continuous dressings of sulphate of ammonia.

Since these experiments were carried out, a number of fertilizers have come into use which, although applied on the general lines indicated, present certain special properties which have to be taken into account.

Nitrogen.—The usual practice with all forms is to give these manures in spring. The more gradual their transformation into nitrate the more retentive the soil, and the lower the winter rainfall the less risk is run by seed-bed application to autumn-sown crops. For this purpose, calcium cyanamide or sulphate of ammonia may be suitable in certain circumstances, but evidence on this point is as yet scanty. The autumn application of farmyard manure is often desirable on the grounds of convenience, and this may outweigh the greater loss of nitrates which this practice entails.

Phosphate.—All forms of phosphate are retained by ordinary soils, but in practice a distinction may be drawn between the more soluble types such as superphosphate, dissolved bones and high-soluble basic slag on the one hand, and the more resistant bone meal, low-soluble basic slags, and ground rock phosphate on the other. The former class may be applied in autumn or spring as convenient ; the latter probably have a better chance in arable cultivation by being well mixed with the soil in autumn, although precise experiments on this point are lacking.

Potash.—The potash salts in common use are water-soluble, and what has been said with regard to superphosphate applies to them also. If, for special reasons, low-grade potash salts are to be given to potatoes, autumn application is desirable, as this enables the accompanying chloride, which is injurious to potatoes, to be washed out while the potash is held back till required by the crop.

Lime.—The time for applying liming materials depends on considerations other than the above. The nature of the substance used is as a rule the deciding factor. Burnt lime

is a caustic substance and can be distinctly injurious to young germinating seedlings; it is therefore more suitable for winter than spring application. The same is true of lime products which are in either lumpy or pasty condition, *e.g.*, lump chalk and factory lime. Exposure to winter frost and thaw does much to reduce these materials to fine enough condition for subsequent cultivations to mix them with the soil. On the other hand, ground chalk and ground limestone are mild in their action and can be distributed very thoroughly.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended September 10				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) .. *	9 7*d*	9 7*d*	9 7*d*	9 7*d*	12 1
Nitro-chalk (N. 15½%) .. *	9 7*d*	9 7*d*	9 7*d*	9 7*d*	12 1
Sulphate of ammonia :— Neutral (N. 20·6%) .. *	8 19*d*	8 19*d*	8 19*d*	8 19*d*	8 8
Calcium cyanamide (N. 20·6%) *	8 5*e*	8 5*e*	8 5*e*	8 5*e*	8 0
Kainit (Pot. 14%) .. .. §	3 6	2 19	2 15	2 18	4 2
Potash salts (Pot. 30%) .. §	5 3	4 18	4 12	4 11	3 0
,, (Pot. 20%) .. §	3 15	3 9	3 3	3 6	3 4
Muriate of potash (Pot. 50%) §	9 17	9 3	8 12	8 16	3 6
Sulphate,, ,, (Pot. 48%) §	11 19	11 6	10 12	10 11	4 5
Basic Slag (P.A. 15¾%)‖ .. §	2 13*c*	2 3*c*	..	2 9*c*	3 1
,, (P.A. 14%)‖ .. §	2 7*c*	1 16*c*	1 16*c*	2 3*c*	3 2
,, (P.A. 11%)‖ .. §	..	1 9*c*	1 9*c*	..	..
Ground rock phosphate (P.A. 26-27½%)‖ .. .. .. §	2 2*a*	2 10*a*	2 5*a*	2 7*a*	1 9
Superphosphate (S.P.A.16%) §	3 11	..	3 9	3 6	4 2
,, (S.P.A.13¾%) §	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3¾%, P.A.20½%) §	8 15	8 10	8 7	6 15	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%) .. .. §	5 17*b*	5 15*f*	5 15	4 7	..

Abbreviations: N. = Nitrogen; P.A. = Phosphoric Acid; S.P.A. = Soluble Phosphoric Acid; Pot. = Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 80% through standard sieve. *a* Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

They may be used at any time and should have preference when it is desired to dress tender young crops in spring.

Organic Manures.—The high-grade and expensive organic manures are, as a class, readily converted into ammonia and nitrate and are therefore quite suitable for spring application. The more resistant types such as hair, feathers, shoddy and sewage sludge can be used as autumn dressings without much risk of loss.

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NOTES ON FEEDING STUFFS

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Roots.—Few subjects have been more warmly argued than that of the desirability of roots for dairy cows. A few years ago every agricultural journal was full of the question, but now the "tumult and the shouting" have died down, and references to it are not so frequent. The pendulum of popular opinion has made the full swing, and, after a certain amount of irregular vacillation, seems to have come to rest somewhere near the centre of its range. There can be no doubt that roots have done much for British agriculture in the past: their introduction and spread in the early part of the eighteenth century revolutionized the management of stock. Up to that date it was difficult to winter stock, and those that were kept did very poorly, whilst many were slaughtered in the autumn and salted down for winter consumption: of the bad effect this had on human health, and of the prevalence of scurvy, enthusiasts on vitamins delight to speak. Agriculturists, however, will think first of the great impediment to the improvement of breeds of livestock that this necessity involved, and it is significant that the giants among the breed improvers arose directly the introduction of roots had made a continuous breeding policy possible. It is not to be wondered at, therefore, that farmers went to extreme lengths in their advocacy of succulent food for winter feeding: so great was the evidence of history that the desirability, or even necessity, of roots for the winter was hardly questioned for many years, and large quantities were generally included in the rations of all stock, especially dairy cows.

After the War, when the outstanding increase in expense by farmers was for labour, root crops became expensive to grow. Hence, when Mr. Boutflour showed that high milk yields could be obtained without including any succulent

food in the winter ration, it is not surprising that many farmers went to the other extreme, and regarded roots as an unjustifiable extravagance, and even asserted that they tended to depress yields. The adoption of the new system entailed, however, much more than the mere dropping of roots from the ration: balanced rations were fed where they had been unbalanced before, bulk was controlled, and in many cases three milkings a day were substituted for two. That much higher yields were obtained by herds managed on this system than they had ever reached before is generally admitted, but the reduction, or omission, of roots was only one part of it, and it is completely illogical to attribute the improvement to that factor alone. The whole question of the economic soundness of roots in the dairy ration is a wide one, but the first part of it is quite clear-cut and straightforward. That part is—are roots beneficial to milk yield when the other conditions are constant and when the ration is a good one? With the object of testing this the present Director of the University Farm and the writer carried out a trial at Cambridge, and in order to increase the data they were very glad to accept the offer of a neighbouring farmer, a careful feeder, to carry out a parallel trial on his farm.

The object was to try the effect of feeding roots and no roots throughout the winter, so that the method of having two lots of cows and changing the rations over in the middle was rejected. The method adopted was to select cows that had already had one lactation or more, during the winter of which they had been fed on normal lines, with 30 to 60 lb. of roots a day, and to feed them during the winter of their next lactation without any succulent food at all. Water was continually before all the cows (so that that factor was eliminated), and during the summer they were all treated alike. Thus the only difference between the treatment during the cow's control lactation (or lactations) and in her experimental one was in the winter feeding. Lactation records were standardized for such things as age by a series of correction factors that had been obtained from large numbers of records previously, and each cow's performance on the dry winter ration was compared with her performance on the normal succulent winter ration. In this way the great variation in milking ability from cow to cow was overcome (different cows were not compared, but the effects of different treatments on the same cow), and consequently the smallness of the numbers was atoned for to a large extent. Five cows had two successive

lactations on dry winter rations, and most had more than one on normal winter rations: these were averaged, the unit of comparison being the cow. On the University Farm thirteen cows figured in the experiment, and of these nine gave lower yields on the dry winter ration, whilst four gave higher. The average decreased yield in the whole lactation by feeding hay and no roots during the winter part of it was 8·2 per cent. This was not quite what statisticians call significant—that is, a difference as large as this might possibly, though of course very improbably, have been due simply to chance. On the private farm the results were very much more definite. Six cows figured and they all gave markedly lower yields on hay: the average decrease amounted to 18·3 per cent., and this certainly could not be attributed to chance.

Putting the two farms together the average loss was found to be 11·4 per cent. This figure again was too large to arise simply by chance, and so may be taken to show that in this experiment the elimination of roots from the winter ration had a definitely harmful effect on yield. Looking at it another way it may be said that on the two farms some 2,300 gallons of milk were lost in 24 lactations by feeding hay instead of roots during the winter.

The same question of the desirability of succulents was attacked by Mr. Jesse. He had been running a cow rationing scheme in East Sussex, and arranged all his returns in groups according to the amount of roots included in the ration. He found that the higher the amount of roots in the ration the higher was the yield. Subsequently Mr. Jesse very kindly sent all his data (including some he had collected since his own statistical inquiry) to the writer, who analysed them with the same objects in view. In all there were 2,252 returns: the average amount of roots fed per cow was 36 lb., this including 223 completely "dry" rations. Comparing these last with the remainder, the following facts emerged:—

223	herds receiving no roots:	average yield per cow	= 20·3 lb.
2,029	,, ,, roots:	,, ,, ,,	= 22·5 ,,

The difference in favour of roots was therefore 2·2 lb., or 10·8 per cent. Here, then, roots had a good effect, and the rise in yield was extremely close to the figure (11·4 per cent.) found in the Cambridge experiment.

There is no doubt of the "significance" of the East Sussex result: the "no-roots" herds gave the lowest average yield, and the yield rose steadily as the amount of roots fed was increased. This result can be stated by saying that between

herd and herd the yield rose by 2½ per cent. for every additional 10 lb. of roots fed per cow. The argument might be advanced that this was not on account of the roots, but due to the herds containing the highest yielding cows receiving the most roots.

This does not sound very probable, but the point can be met. Many herds sent in more than one return during a winter, so that it was possible to see if a change in the ration *in the same herd* brought any change in the yield. Here again the same result emerged, but the rise was somewhat toned down: the average increase in yield produced by an increase of 10 lb. of roots in the ration was found to be about 1¼ per cent.

This is rather interesting: from herd to herd the yield rises by 2½ per cent. for every 10 lb. increase in roots, but if a particular herd has its root ration put up by that amount it only gives about one-half of that increase. An explanation of this would be provided by the view that roots raise the yield by keeping the cow in better condition: if this is so the general level of root feeding would be of more importance than comparatively minor alterations in the exact amount fed. This explanation is a reasonable one, for the best condition for a dairy cow is a moderately loose one, and roots certainly help in attaining this. The point has been made before in these notes that this loose condition is necessary, as it means a more rapid progress of the food through the body, and so is tantamount to raising the intestinal capacity. If roots are chiefly effective by speeding up the rate of digestion it may be that, though in general useful, they can be dispensed with without lowering yields if the other foods are carefully selected to give a fairly laxative mixture. This means that cows can be correctly fed without roots, but that it is easier with them.

There are other possible explanations of the fact that roots tend to raise yields. It has been shown that succulent foods contain substances which assist in the assimilation of minerals; they may have an effect in raising the total water intake of the animal; and it has also been suggested that they have a direct stimulating effect. A consideration of the question of specific actions of foods, however, must be postponed.

Roots are often objected to as bulky, but this is unreasonable in view of the fact that their starch equivalent (on a dry matter basis) is higher than that of what is usually substituted for them—hay. Taking roots at 10·7 per cent. dry matter and 5·5 starch equivalent per 100 lb., and hay as 84 per cent. dry matter with starch equivalent of 40·4 per 100 lb., it is seen that the starch equivalent of 100 lb. of dry matter in roots is

51·4, as compared with 48·1 for hay. It is true that the 100 lb. of dry matter in roots is accompanied by much water, but in view of the rapid rate of passage of this through the intestine, and of the fact that if not provided by the food it will be drunk, it can hardly be considered to contribute sensibly to bulk, as that word is generally used in animal feeding. Hay, however, would contain rather more protein.

Opinion now leans to the view that succulent foods are helpful in putting the yield up slightly. One or two experimental inquiries have given the opposite result, a few have indicated no effect for them, but most trials have come out in their favour. Practical experience also points in this direction, though, as in many other cases, practical men disagree very much. In Denmark, farmers have such faith in succulent foods that they are fed as the productive part of the ration—that is, the highest yielding cows get the most. In India provision of succulents is difficult, but if they can be obtained for the hot weather they are found not only to raise the yield, but also to have a very marked effect in keeping the cows in good health: this point was stressed in a book recently published on Indian crop production.*

The pendulum has completed its swing, and we find it unstable at either end: roots are beneficial to yield, but not essential. Without special precautions being taken to ensure a laxative condition of the cows, they are helpful and, on the average, raise the yield by about 10 per cent. This amount is fairly considerable and well worth aiming for if the roots can be produced cheaply. Thus we come to the advice commonly given to-day, that if a farmer can grow, under his conditions of soil and climate, heavy crops of mangolds, he should feed them in moderation (up to about 60 lb. a day); if the farm is unsuitable for root-growing, the crop is expensive to grow and consequently dear to feed, and then it may be good policy to avoid it; if, however, no succulent food is provided great care must be taken to keep the cows in the right condition, and, in general, a slightly lower yield must be expected.

* A. Howard: *Crop Production in India: A Critical Survey of Its Problems*, Oxford University Press.

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DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	8 10	0 11	7 19	72	2 2	1·16	9·6
Barley Danubian	20 3	400	5 13	0 8	5 5	71	1 6	0·80	6·2
„ Persian	19 0	„	5 7	0 8	4 19	71	1 5	0·76	6·2
„ Russian	21 3	„	5 18*	0 8	5 10	71	1 7	0·85	6·2
Oats, English, white	—	—	6 15	0 9	6 6	60	2 1	1·12	7·6
„ „ black and grey	—	—	6 0	0 9	5 11	60	1 10	0·98	7·6
„ Argentine	16 9	320	5 17	0 9	5 8	60	1 10	0·98	7·6
„ Chilian	16 9	„	5 17	0 9	5 8	60	1 10	0·98	7·6
„ German	23 3	„	8 3	0 9	7 14	60	2 7	1·38	7·6
Maize, Argentine	30 0	480	7 0	0 9	6 11	81	1 7	0·85	6·8
„ South African	32 9	„	7 13†	0 9	7 4	81	1 9	0·94	6·8
Peas, Japanese	—	—	18 15†	0 19	17 16	69	5 2	2·77	18
Dari	—	—	8 0	0 10	7 10	74	2 0	1·07	7·2
Milling offals—									
Bran, British..	—	—	5 5	0 19	4 6	42	2 1	1·12	10
„ broad	—	—	6 0	0 19	5 1	42	2 5	1·29	10
Middlings, fine, imported ..	—	—	6 10	0 15	5 15	69	1 8	0·89	12
„ coarse, British ..	—	—	6 5	0 15	5 10	58	1 11	1·03	11
Pollards, imported	—	—	5 7	0 19	4 8	60	1 6	0·80	11
Meal, barley	—	—	7 5	0 8	6 17	71	1 11	1·03	6·2
„ maize	—	—	8 15*	0 9	8 6	81	2 1	1·12	6·8
„ „ South African ..	—	—	7 0†	0 9	6 11	81	1 7	0·85	6·8
„ „ germ	—	—	6 12	0 13	5 19	85	1 5	0·76	10
„ locust bean	—	—	7 10	0 7	7 3	71	2 0	1·07	3·6
„ bean	—	—	10 15	1 2	9 13	66	2 11	1·56	20
Maize, cooked flaked	—	—	9 0	0 9	8 11	83	2 1	1·12	8·6
„ gluten feed	—	—	6 15	0 17	5 18	76	1 7	0·85	19
Linseed cake, English, 12% oil	—	—	11 0	1 6	9 14	74	2 7	1·38	25
„ „ „ 9% „	—	—	10 7	1 6	9 1	74	2 5	1·29	25
„ „ „ 8% „	—	—	10 0	1 6	8 14	74	2 4	1.25	25
Soya bean cake, 5½% oil ..	—	—	9 0§	1 16	7 4	69	2 1	1·12	36
Cottonseed cake—									
„ „ English, 4½% oil	—	—	5 5	1 4	4 1	42	1 11	1·03	17
„ „ Egyptian, 4½% „	—	—	4 15	1 4	3 11	42	1 8	0·89	17
Ground-nut cake, 6-7% oil ..	—	—	6 15*	1 4	5 11	57	1 11	1·03	27
Decorticated ground-nut cake, 6-7% oil	—	—	8 2	1 16	6 6	73	1 9	0·94	41
Palm kernel cake, 4½-5½% „	—	—	6 10*	0 15	5 15	75	1 6	0·80	17
„ „ „ meal, 4½% „	—	—	6 10§	0 15	5 15	75	1 6	0.80	17
„ „ meal 1-2% oil ..	—	—	5 15§	0 16	4 19	71	1 5	0·76	17
Feeding treacle	—	—	6 15†	0 8	6 7	51	2 6	1·34	2·7
Brewers' grains, dried ale ..	—	—	5 0	0 16	4 4	48	1 9	0·94	13
„ „ „ porter ..	—	—	4 12	0 16	3 16	48	1 7	0·85	13
Malt culms	—	—	6 0†	1 4	4 16	43	2 3	1·20	16

* At Bristol. † At Liverpool. § At Hull.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have take place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end August and are, as a rule, considerably lower than the prices at local country markets, the difference being due carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on off at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally £7 per ton, then since its manurial value is 15s. per ton as shown above, the food value per ton is £6 5s. Dividir this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivale is 1s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. starch equivalent is 0·89d. A similar calculation will show the relative cost per lb. of starch equivalent of other feedir stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives hi the best value at the prices quoted on his own markets. The figures given in the table under the heading manuri value per ton are calculated on the basis of the following unit prices:—N., 8s. 0d.; P_2O_5, 2s. 11d.; K_2O, 3s. 0d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow:—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6·2	5 13
Maize	81	6·8	7 6
Decorticated ground nut cake	73	41·0	8 2
„ cotton cake	71	34·0	8 15

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·71 shillings, and per unit protein equivalent, 1·48 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1929, issue of the Ministry's JOURNAL.)

FARM VALUES

CROPS	Starch equivalent Per cent.	Protein equivalent Per cent.	Food value per ton, on farm £ s.
Wheat	72	9·6	6 17
Oats	60	7·6	5 14
Barley	71	6·2	6 10
Potatoes	18	0·6	1 12
Swedes	7	0·7	0 13
Mangolds	7	0·4	0 12
Beans	66	20·0	7 2
Good meadow hay	37	4·6	3 10
Good oat straw	20	0·9	1 15
Good clover hay	38	7·0	3 15
Vetch and oat silage	13	1·6	1 5
Barley Straw	23	0·7	2 0
Wheat straw	13	0·1	1 2
Bean straw	23	1·7	2 2

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, price 6d. net.

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MISCELLANEOUS NOTES

The Agricultural Index Number

PRICES of agricultural produce during August were on the average 35 per cent. above those ruling in the corresponding month of the base years 1911-13, as compared with 34 per cent. in July and 52 per cent. in August, 1929. Prices were fairly steady during the month under review and the rise of one point in the index number was due to a number of small alterations in the individual indices, principally those of fat cattle, pigs, cereals and potatoes, partially offset by those for fat sheep and hay. In comparing with last year, however, it should be borne in mind that although a large number of commodities were dearer than at present, milk prices in August, 1929, were fixed at winter levels, whereas in August, 1930, summer prices ruled.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	37
May	57	50	42	54	44	34
June	53	48	41	53	40	31
July	49	48	42	45	41	34
August	54	49	42	44	52	35
September	55	55	43	44	52	—
October	53	48	40	39	42	—
November	54	48	37	41	44	—
December	54	46	38	40	43	—

Grain.—Both wheat and barley were 1d. per cwt. dearer in August than in July, but oats were reduced by a similar amount. The index number for wheat rose by 2 points to 4 per cent. above pre-war, but barley was unchanged at 12 per cent. below 1911-13. In the case of oats the fall in price was proportionately much less than that recorded in the base years, and the index figure advanced by 7 points to 13 per cent. less than pre-war. A year ago wheat was 46 per cent., barley 31 per cent., and oats were 30 per cent. dearer than in 1911-13.

Live Stock.—Average values for fat cattle were unchanged on the month, but as a reduction occurred in the base years the index number was 7 points higher at 37 per cent. above pre-war. Fat sheep were about ½d. per lb. cheaper at 62 per cent. in excess of pre-war, while prices of both bacon pigs and pork pigs rose by 6d. per score lb. and the relative index figures by one point to 41 and 50 per cent. above 1911-13. Quotations for dairy cows continued to move upwards, the average price in August showing an advance of about 13s. per head over the July figure. Store cattle, however, sold at slightly reduced prices and store sheep were fully 4s. 6d. per head cheaper on the month : the index for the latter fell by 12 points to 66 per cent. above the level of the base years. Following a series of comparatively small reductions since March last, values for store pigs moved upwards in August, and the index number was 12 points higher at 112 per cent. in excess of 1911-13. In August, 1929, the index figure for store pigs stood at 85 per cent. above pre-war.

Dairy and Poultry Produce.—Milk was unchanged either in price or index number, but butter prices rose by about 1½d. per lb. and the index figure by 2 points. Cheese was a little cheaper than in July and the index number was 4 points lower at 28 per cent. in excess of the level of the base years. As is customary at this time of the year, eggs realised higher prices, the average in August advancing by about 1½d. per dozen. The increase, however, was proportionately less than in the corresponding period of 1911-13 and the index number at 40 per cent. above pre-war was 4 points lower than in July. This level is below any recorded for August since 1915. Values for poultry receded further, a decline of 4 points being recorded in the index figure.

Other Commodities.—Prices of first early potatoes fell by fully 35s. per ton during the month under review, but as the reduction was proportionately less marked than in the base years, the index figure showed an advance of 2 points to 25 per cent. over pre-war. A year ago, the corresponding figure was only 2 per cent. above 1911-13. Quotations for hay were again lower, clover hay declining by about 9s. per ton and meadow by 1s. 6d., the composite index figure for both varieties showing a fall of 3 points to 15 per cent. above 1911-13. Fruit prices in August fell to below pre-war levels, apples being about 5 per cent. and plums about 10 per cent. cheaper. At the corresponding period in 1929, apples were realizing about 30 per cent. more than pre-war and plums more than double their present prices. Green vegetables, at 54 per cent. above the level of the base years, were rather cheaper than in July. Wool showed no material change either in price or index number.

Index numbers of different commodities during recent months and in August, 1928 and 1929, are shown below :—

Percentage Increase as compared with the Average Prices ruling in the corresponding months of 1911–13.

Commodity	1928	1929	1930			
	Aug.	Aug.	May.	June.	July.	Aug.
Wheat	30	46	11	7	2	4
Barley	58	31	—1*	—4*	—12*	—12*
Oats..	49	30	—11*	—16*	—20*	—13*
Fat cattle	40	36	30	27	30	37
Fat sheep	59	59	63	66	66	62
Bacon pigs	36	60	61	46	40	41
Pork pigs	33	60	67	52	49	50
Dairy cows..	33	35	29	29	32	35
Store cattle..	29	19	28	28	29	30
Store sheep..	55	64	46	65	78	66
Store pigs	26	85	108	101	100	112
Eggs	55	59	28	29	44	40
Poultry	45	47	64	57	47	43
Milk	55	93	55	55	58	58
Butter	54	48	23	24	31	33
Cheese	84	62	52	42	32	28
Potatoes	35	2	—36*	—40*	23	25
Hay	13	41	28	25	18	15
Wool	76	47	Nil	—1*	—4*	—5*

* Decrease.

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National Institute of Agricultural Botany : Report

THE Annual Report of the National Institute for Agricultural Botany covering the season 1928–29 and the series trials which were concluded in that season has now been received (Journal of the Institute, Vol. II., No. 3, 1930. Heffer & Sons, Ltd. Price 2s. 6d. net). The series trials ended in 1929, included in the report, are those of Spring Sown Barleys, Spring Sown Oats and Maincrop Potatoes. The conclusions drawn from these trials are, in the opinion of the Institute, of definite value to the farmer as they show the relative value of the varieties tested. In addition to these reports there are reports on "Cereal Crops in Essex, 1927–28," the "Lord Derby Gold Medal Potato Trials, 1929," the "Report of the Potato Synonym Committee, 1929," and the "Eleventh Annual Report of the Official Seed Testing Station for England and Wales (1927–1928)." The report is concluded by an interesting paper on "The Work of the Institute," by E. S. Beaven, LL.D., which describes in summary form the whole of its activities.

Export of Breeding Stock

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland during the three months ended June, 1930, compared with the corresponding period of 1929. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	April to June, 1930		April to June, 1929	
	Number	Declared value	Number	Declared value
CATTLE		£		£
Argentina	140	22,255	185	45,878
Brazil	28	2,485	82	7,715
Chile	1	112	13	1,255
Uruguay	41	5,280	47	7,965
United States of America	57	5,183	30	3,250
Australia..	50	5,400	47	11,243
Canada	226	15,335	179	15,225
Irish Free State.. ..	489	14,119	604	12,832
Kenya	15	914	7	375
Southern Rhodesia ..	6	346	19	1,995
Union of South Africa ..	17	1,082	45	2,837
Other countries	12	637	36	2,812
Total	1,082	73,148	1,294	113,382
SHEEP AND LAMBS				
Argentina	2	50	42	940
Brazil	84	1,845	85	1,271
Chile	9	380	3	375
France	37	344	39	444
Sweden	27	612	0	0
United States of America	122	1,847	130	1,685
Uruguay	0	0	15	205
Canada	369	6,102	13	195
Irish Free State.. ..	14	158	16	317
Union of South Africa ..	54	685	12	225
Other countries	20	427	40	856
Total	738	12,450	395	6,513
SWINE				
Denmark..	0	0	29	520
France	9	145	1	10
Germany..	10	360	5	60
Netherlands	3	42	0	0
Poland	1	25	5	170
Portugal	3	120	3	60
Irish Free State.. ..	48	600	49	257
Union of South Africa ..	9	230	10	261
Other countries	4	117	12	412
Total	87	1,639	114	1,750

Agricultural Exhibition in Egypt

THE 14th Egyptian General Industrial and Agricultural Exhibition will be held for one month, beginning on February 15, 1931, in the grounds of the Royal Agricultural Society at Gezirah, Cairo—under the patronage of King Fouad. A special committee, under the Chairmanship of Abbas Pasha El Daramalli, has been appointed to control the organization of the exhibition, the objects being the same as those of the exhibition held in 1926, *i.e.*, the development of Egyptian agriculture and industry and the promotion of the use of agricultural machines and accessories. Exhibits from abroad will, therefore, only be admitted if they have a direct interest for agriculture. The Direction will welcome the co-operation of overseas manufacturers of machines, implements and other articles within the scope of the Exhibition, which are suitable for use in Egypt.

Requests for space should be addressed to the Directeur de l'Exposition Générale Agricole et Industrielle—B.P. 63, Le Caire, Egypt.

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East Malling Research Station Report

THE Seventeenth Annual Report of this Station, covering its activities and development during 1929, has been issued. The reception of a number of post-graduate research workers has been arranged for on the invitation of the Empire Marketing Board, and it is stated that a Technical Officer who has been appointed will devote part of his time to shepherding these students. The arrangements for the accommodation of the Imperial Bureau of Fruit Production at the Station, mentioned in the Report, have already been described in this JOURNAL (July, 1930). New premises, known as the Ditton Laboratories, near the entrance of the Station, will come into occupation of members of the staff of the Cambridge Low Temperature Station and it is hoped that the grading and packing organization will be working in close collaboration with their new neighbours by the time this note appears.

A section of the report deals with the Station Farm during the year and supplies interesting details of the conditions of the work and of the crops harvested. As might be expected, however, the main body of the report is devoted to a brief progress report of investigations undertaken for fruit growers and summaries of their results. A list of the published reports

by members of the staff of the Station is included. Both of these questions cover a wide range of subject matter, well known to horticultural readers of this JOURNAL. The Report is distributed free to Associate Members of the Station, and its price to non-members is 2s. 6d. net, plus 6d. postage.

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Special Research Grants

THE following awards of special research grants for 1930–31 have been made on the recommendation of the Advisory Committee on Agricultural Science :—

Institution	*Investigation*	*Amount* S=Salary E=Expenses £	*Investigator(s)*
	I—Renewals		
Bangor	Kemp in the fleece of Welsh Mountain Sheep.	E 150	R. G. White and J. A. Fraser Roberts
Bristol, Long Ashton Research Station.	Long Ashton winter washes.	E 150	C. L. Walton, F. Tutin and L. N. Staniland.
Cambridge, Department of Animal Pathology.	Use of B. C. G. Vaccine	E 375	Prof. J. B. Buxton and Dr. A. S. Griffith.
Cambridge, School of Agriculture.	Grassland investigations.	E 200	Pasture Sub-Committee of the Advisory Committee.
Cambridge, School of Agriculture.	Good and bad fields of wheat.	S 300 E 30	G. A. Stevenson.
Liverpool University.	Pregnancy disease in ewes.	E 200	Prof. S. H. Gaiger and K. D. Downham.
Oxford, School of Rural Economy.	Breeding of oats for resistance to frit fly.	E 273	N. Cunliffe.
Rothamsted Experimental Station.	Examination of data collected under the Agricultural Meteorological Scheme.	S 165* E 55	J. O. Irwin.
Wye, South-Eastern Agricultural College.	Struck and gangrene diseases in sheep on Romney Marsh.	E 350	A. D. McEwen.
	II—New Grants		
Cambridge, School of Agriculture.	Study of effects of stubble cleaning.	S 300 E 30	W. A. Jones.
Reading University.	Solids-not-fat in milk.	S & E 200	H. H. Nicholson and Assistant.
Seale Hayne Agricultural College.	Crossing of broccoli	E 116	F. R. Horne.

* Grant for six months for termination of investigations.

Ministry of Agriculture Scholarships

THE number of candidates this year for scholarships offered by the Ministry for the sons and daughters of agricultural workmen and others was 611, and 133 awards have been made. These comprise 12 senior scholarships for either degree or diploma courses in agriculture or an allied subject at the Universities and Agricultural Colleges; 111 junior scholarships for short courses not exceeding one year, tenable at Farm Institutes; and 10 extended junior scholarships for courses of further instruction at Farm Institutes.

The origins of the successful candidates this year, as compared with those in the three previous years, are set out in the following table :—

Occupation of Parents	1927	1928	1929	1930
Agricultural Workman	36	34	38	39
Working Bailiff	8	8	6	17
Smallholder	29	29	33	21
Other rural occupations (*e.g.*, blacksmith, harness maker, market gardener, etc.)	11	12	19	19
Candidates who qualified on their own account as *bona fide* workers in agriculture	35	27	26	37
	119	110	122	133

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Agricultural Scholars : Foreign Study

THE following arrangements have been made for foreign studies of post-graduate agricultural teaching and agricultural research scholars of the Ministry of Agriculture in the academic year, 1930-31 :—

(1) AGRICULTURAL TEACHING SCHOLARS

Scholar	*Subject*	*Centre of Study*
Jones, W. H.	Economics	Harvard (Prof. J. D. Black).
Edwards, J.	Live Stock Improvement.	Minnesota (Dr. Eckles).
Hirst, H.	Animal Husbandry.	Ditto.

(2) AGRICULTURAL RESEARCH SCHOLARS

Bogue, J. Y.	Veterinary Physiology	Berlin (Prof. Cremer).
Bell, G. D. H.	Plant Genetics	U. S. A. Bureau of Plant Industry Stations.
Catchpole, H. R.	Animal Nutrition	California.

Grants for travelling and maintenance purposes are being made to these scholars in respect of the cost entailed by these programmes of study.

United Dairies Scholarships

THE sixth annual award of scholarships from the United Dairies Scholarship Fund has recently been made. This fund, which amounts to £30,000, was created in 1924 by the United Dairies, Ltd., for the purpose of promoting and encouraging practical and scientific education in dairying and dairy farming. The fund also provides for one or more travelling and research scholarships to enable advanced students to study these subjects at home and abroad. The trustees and executive committee of the fund are :—Mr. A. L. Hobhouse (Chairman) representing the Somerset County Council; Mr. H. E. Dale (Trustee) representing the Ministry of Agriculture and Fisheries; Mr. E. W. Langford (Trustee) representing the National Farmers' Union; Mr. J. F. Phillips (Trustee) representing the United Dairies, Ltd.; and Professor H. A. D. Neville representing the University of Reading.

The scholarships, which are open to the sons and daughters of farmers and smallholders in Somerset, Cornwall, Devon and Dorset, are tenable at Reading University, the Seale-Hayne Agricultural College (Newton Abbot, Devon), and the Somerset Farm Institute (Cannington, Bridgwater). Nine ordinary scholarships were awarded this year, the successful candidates being as follows :—

Two Years' Diploma Course in Dairying at Reading University—
John Vyvyan Berryman and John Boyce Fry.

One Year's Extension of Diploma Course in Dairying at Reading University—
Raymond Herbert Weeks.

One Year's Extension of Course at Seale-Hayne Agricultural College—
John H. Cock.

One Year's Course in Dairying at Somerset Farm Institute, Cannington—
Miss Muriel Eileen Cottle, Miss Violet Hiscock, Jack Elliott Mellish, Miss Sylvia A. T. Osborn, Miss Muriel Irene Passmore.

Mr. R. H. Weeks was awarded a two-years' course at Reading University in 1928 and Mr. J. H. Cock was awarded a two-years' course at Seale-Hayne Agricultural College in 1926. The awards now made will enable them to continue their training in dairying work.

The terms and conditions of both ordinary and research scholarships for next year will be issued about May, 1931.

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Rothamsted Winter Lectures

DURING the forthcoming winter it would be possible for Mr. H. V. Garner, the Guide Demonstrator at the Rothamsted Experimental Station, and other members of the staff whose names are appended, to give a few lectures to Chambers of Agriculture and Horticulture, Farmers' Clubs, Farm Workers' Associations, Agricultural Societies, etc. The lectures would deal with the Rothamsted Experiments, and the titles of lectures and names of lecturers are given below. It is not practicable to deal with more than one subject in a single lecture. Bodies who would care to avail themselves of the services of the lecturers named should indicate the subject or subjects which would be of most interest to them, when an endeavour would be made to arrange for the lectures on the dates desired. The longest possible notice is requested.

A fee will not be charged for the lecturers' services, but any Association engaging them would be expected to defray their travelling and hotel expenses and to make such arrangements for the lectures as may be necessary.

All communications regarding lectures should be addressed to *The Secretary, Rothamsted Experimental Station, Harpenden, Herts.*

LECTURES BY MR. H. V. GARNER, M.A., B.Sc. (*Guide Demonstrator*)

(1) Some principles of manuring and their application on the farm.
(2) The use of fertilizers on grass land.
(3) Experiments with sugar beet.
(4) The manuring of potatoes in the light of recent experiments.
(5) Nitrogen for cereals: some points in its use.
(6) Some results of the Rothamsted Experiments on commercial farms.
(7) Experience with the newer fertilizers.

OTHER LECTURES

(1) *Soil Micro-Organisms (Bacteria, Protozoa, etc.)*	
Lucerne Inoculation	Dr. H. G. Thornton, B.A.
Life in the Soil	Mr. D. W. Cutler, M.A.
Biological Aspects of Partial Sterilization	Mr. D. W. Cutler, M.A.
(2) *Agricultural Botany*	
Weeds of Arable and Grass Land	Dr. Winifred E. Brenchley, F.L.S.
(3) *Agricultural Chemistry*	
Liming and Chalking of Soils	Dr. E. M. Crowther, F.I.C.
Recent Developments in the Production and Use of Fertilizers	Dr. E. M. Crowther, F.I.C.
(4) *Soil Physics*	
Soil Acidity: Its Cause and Control	Dr. R. K. Schofield, M.A
Modern Developments in Soil Cultivation	Mr. G. W. Scott Blair, M.A

(5) *Entomology*	
Insect Pests	Dr. A. D. Imms, M.A., F.R.S.
Bee Keeping	Mr. D. M. T. Morland, M.A.
Fruit Pests	Dr. H. F. Barnes, B.A.
(6) *Mycology*	
Plant Diseases: their Causes and Control	Dr. W. B. Brierley, F.L.S.
Soil Fungi and Plant Growth	Dr. W. B. Brierley, F.L.S.
Fungous Diseases of Crops	Dr. W. B. Brierley, F.L.S.
Virus Diseases of Plants	Dr. J. Henderson Smith B.A. Dr. J. Caldwell, M.A.
Plant Diseases: their Causes and Control	Mr. R. H. Stoughton, B.Sc.
Bacterial Diseases of Crops	Mr. R. H. Stoughton, B.Sc.

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Importation of Flower Bulbs into Germany

THE Ministry has been informed that a Decree has recently been issued prohibiting the importation into Germany of flower bulbs, tubers, etc., unless they are accompanied by an official certificate of freedom from certain diseases and pests specified in the Decree.

The issue of such certificates involves examination of the bulbs, and the Ministry will be prepared to undertake this inspection in accordance with the arrangements already in force for the examination of plants, etc., destined for export to other countries for which health certificates are required.

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Stud Goat Scheme, 1930-31

THIS Scheme, having for its object the improvement of the productive quality of milch goats kept by smallholders, cottagers and others of similar position, is again in operation. For the current breeding season, which lasts till February 28 next, 105 stud goats have been registered and are standing at various centres throughout the country, including 11 in Wales, and their services are available for goats belonging to persons in the above-mentioned categories at a nominal fee, in no case exceeding 5s. Conditions of service and other information may be obtained from the County Agricultural Organizers at their respective County Education Offices, or from the Honorary Secretary of the British Goat Society, which is responsible for the administration of the Scheme, at 10 Lloyd's Avenue, London, E.C.3.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND.

Bedfordshire : Miss F. M. Hill, N.D.P., has been appointed Instructress in Poultry-keeping, *vice* Miss D. Thompson.

Buckinghamshire : Mr. E. H. Brant, B.Sc., N.D.A., has been appointed Assistant Instructor in Agriculture.

Mr. C. Turner, N.D.A., N.D.D., has been appointed Assistant Instructor in Dairying.

Mr. W. R. W. Barnett* has been appointed Assistant Instructor in Horticulture.

Cheshire : Mr. R. G. Druce, B.Sc., B.Agric., has been appointed Lecturer in Biology at the Cheshire School of Agriculture, *vice* Mr. F. W. Hankinson, B.Sc., appointed District Lecturer in Agriculture.

Mr. H. Fairbank has been appointed Head Gardener at the Cheshire School of Agriculture, *vice* Mr. P. Shaw.

Cumberland and Westmorland : Miss B. Lang, N.D.P., has been appointed Assistant Poultry Instructress at the Newton Rigg Farm School, *vice* Miss Pringle, N.D.D., C.D.P.

Devonshire : Mr. R. D. H. Bridge has been appointed Assistant Instructor in Poultry Keeping, *vice* Mr. E. V. Beard.

Dorsetshire : Mr. R. Wightman, B.Sc., has been appointed Senior Agricultural Lecturer and Adviser.

Gloucestershire : Mr. T. H. Lunson, N.D.A., N.D.D., has been appointed Assistant Instructor in Agriculture, *vice* Mr. R. Line.

Hampshire : Miss M. Davies-Cooke, N.D.D., B.D.F.D., has been appointed Instructress in Dairying at Sparsholt Farm Institute, *vice* Miss G. Bowden.

Mr. W. Inglis has been appointed Manager of the County Egg Laying Trials, *vice* Miss E. M. Hissett.

Isle of Wight : Mr. B. Jenkins, M.Sc., has been appointed County Agricultural Education Officer.

Lincolnshire (Holland) : Mr. D. E. Horton has been appointed Assistant for Bulb Research.

Staffordshire : Mr. J. T. Craig, N.D.A., has been appointed Assistant Instructor in Agriculture.

Mr. J. Cooke has been appointed Manager of the County Egg Laying Trials, *vice* Mr. R. D. Scott.

Suffolk (East and West) : Mr. W. Longwill has been appointed Manager of the joint County Egg Laying Trials.

Wiltshire : Mr. T. C. Goddard, B.Sc., N.D.D., has been appointed Assistant Organizer for Dairy Husbandry.

* Wholly employed by the County Council, but only partially on agricultural education work.

WALES.

Carmarthenshire : Miss Eira Jones has not accepted the post of Instructress in Rural Domestic Economy, the notification of her appointment in the July, 1930, issue of this JOURNAL is cancelled, and the post remains vacant.

Monmouthshire : Mr. E. W. Hobbis has been appointed Assistant Instructor in Horticulture.

Mr. F. R. Wallbutton has been appointed Assistant Instructor in Poultry Keeping.

CHADACRE AGRICULTURAL INSTITUTE (Hartest, Bury St. Edmunds)

The following appointments have been notified as taking effect as from October 1, 1930 :—

Mr. J. R. Carter, Dip. Agr. (Wye), has been appointed Vice-Principal, *vice* Mr. G. L. Maw, B.Sc.

Miss E. M. Watson, N.D.D., U.D.A., has been appointed Instructress in Dairying and Poultry Keeping, *vice* Miss M. C. Thomas, N.D.D., B.D.F.D.

Mr. P. W. L. Hook has been re-appointed Third Master for the Winter Session, 1930-31.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES.

School of Agriculture, University of Cambridge.

The following is the revised list of the Teaching Staff, as given in the *Handbook* to the School, just published by the Cambridge University Press, price 2s. 6d. :—

Agriculture	
Drapers' Professor	F. L. ENGLEDOW, M.A. (Director of Advanced Students).
Lecturer	W. S. MANSFIELD, M.A. (Director of the University Farm).
Demonstrator	W. K. HUBBLE, B.A. (Assistant Demonstrator at the University Farm).
Agricultural Botany	
Professor	Sir R. H. BIFFEN, M.A., F.R.S.
Lecturer	J. LINE, M.A.
Plant Diseases	
Lecturer	F. T. BROOKS, M.A.
Animal Pathology	
Professor	J. B. BUXTON, M.A., F.R.C.V.S., D.V.H.
Animal Husbandry	
Lecturer	F. H. GARNER, M.A.
Crop Husbandry	
Lecturer	H. G. SANDERS, M.A., Ph.D.
Agricultural Physiology	
Reader..	F. H. A. MARSHALL, ScD., F.R.S.
Agricultural Biology	
Demonstrator	A. WALTON, Ph.D.
Agricultural Chemistry	
Lecturer	H. E. WOODMAN, M.A., D.Sc.
Agricultural History and Economics	
Lecturer	J. A. VENN, Litt.D.
Estate Management	
Lecturer	E. P. WELLER, M.A., F.S.I., F.L.A.S.
Demonstrator	N. DEAN, M.A., F.S.I., M.R.San.I.
Agricultural Analysis	
Demonstator	L. F. NEWMAN, M.A., F.I.C.
Statistics	
Lecturer	G. UDNEY YULE, C.B.E., M.A., F.R.S.
Physics and Engineering	
Lecturer	J. E. FEW, M.A., LL.B.

Economic Entomology
Lecturer .. .. .. C. WARBURTON, M.A.
Veterinary Science
Lecturer .. .. .. Col. W. A. WOOD, C.B.E., M.A., M.R.C.V.S.

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Enforcement of Minimum Rates of Wages.—During the month ending September 14, legal proceedings were instituted against nine employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County.	Court	Fines £ s. d.	Costs £ s. d.	Arrears of wages £ s. d.	No. of workers involved
Chester ..	Chester ..	1 0 0	—	13 13 6	1
Cumberland	Wigton ..	*	0 14 0	25 8 0	1
Devon ..	Axminster ..	5 0 0†	—	55 0 0	3
Gloucester.	Gloucester ..	1 10 0	1 9 0	45 0 8	3
" .	Newnham-on Severn	1 0 0	0 18 6	3 10 3	1
Monmouth.	Pontypool ..	2 0 0	—	0 13 10	1
Norfolk ..	East Dereham	0 15 0	—	7 4 6	3
Denbigh ..	Ruthin ..	*	1 12 0	10 0 0	1
Radnor ..	Talgarth ..	3 0 0	—	10 0 0	1
		£14 5 0	£4 13 6	£170 10 9	15

* Dismissed under Probation of Offenders Act.
† Including costs.

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Foot-and-Mouth Disease.—An outbreak was confirmed on September 6 at Holbeck, Leeds, Yorkshire, West Riding, and two further cases were confirmed on the following day in the same locality. These are the first cases to occur in Great Britain since the outbreak at Goring-on-Sea, Worthing, West Sussex, confirmed on December 23, 1929; that is, after a period of more than eight months' complete freedom from the disease. On September 15, two outbreaks were also confirmed at Pirbright, Surrey. On September 20, a new centre of disease was discovered at Beesdale, Stokesley, Yorks (N.R.). The usual restrictions were applied to an area of approximately fifteen miles round the infected premises at each centre of disease.

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NOTICES OF BOOKS

Rothamsted Memoirs on Agricultural Science. Pp. 905. Royal 8vo, half-calf. (Published at the Rothamsted Experimental Station, Harpenden, Herts. Price 36s. net. Inland post free; Foreign post extra.)

This volume, which includes 64 memoirs, covering the period from 1928 to 1930, is now ready for distribution, and copies can be obtained on application to the Secretary of the Station, as above. It is requested that orders for the work should, as far as possible, be accompanied by remittances and, as the edition is strictly limited, early application is advisable.

International Directory of Pedigree Stock Breeders, Vol. III, 1930-31. Pp. 1100. (London: The Vernon Press, Ltd. Price 30s. net.)

This, the third and revised edition of the Directory, contains alphabetical lists of the names, with addresses, of some 120,000 breeders of all classes of pedigree live stock in all parts of the world. The book, which is well illustrated, contains interesting information upon live stock breeding in the different countries, and descriptions of the various breeds of stock, together with articles on general topics connected with breeding. Among other features of this edition is a new section giving the names of breeders of thoroughbred horses in Great Britain and Ireland and some 20 other countries in which the breeding of blood stock is prominent.

Pests in Wheat and its Products.—By Sebert Humphries. Pp. 36. Technical Education Series Pamphlet No. 5 (The National Joint Industrial Council for the Flour Milling Industry, 26-28 King's Road, Chelsea, London, S.W. 3. Price 6d. net.)

This pamphlet is divided into two parts, the first of which deals with the "Suppression of Pests" and the second with the "Pests Themselves." The long struggle against the pests which flourished in the large bulk of wheat, stored in Australia for the Royal Commission on Wheat Supplies, during the latter years of the war and just after, is fully described; and from that point of departure a description of the various modern methods of combating the pests is fully entered into. The second part gives a brief entomological description of the pests divided into four sections, *i.e.*, Beetles (which include Weevils), Moths, Worms and Mites, and is concluded by a few notes on the parasites of pests.

Heredity in Livestock. By Christian Wriedt. Pp. xi + 179. Illustrated. (London: Macmillan and Company, Limited. 1930. Price 7s. 6d. net.)

It would have been impossible for any man of science writing on heredity with the purpose of making that science useful to the breeder to have avoided some reference to the work of the great breeders of the eighteenth century, because it is upon their work that much of modern practice is based. The consideration of these men's work by Christian Wriedt is a guarantee of Professor Punnett's statement, in his foreword to the book, that Wriedt acted the part, as was his ambition, of a liaison officer between men of science and practical breeders. The book makes available, in simple and non-technical language, the findings of modern science in heredity. The author critically examines a great many experiments, and explains their application to the problems of mating farm animals so as to obtain the best economic results.

The book opens with a discussion of the Mendelian law of heredity and goes on to a discussion of the factors influencing the inheritance of size, capacity for milk production, the butter fat content of milk, etc. The vexed question of in-breeding is fully treated in three chapters devoted to cattle, horses and pigs, sheep and poultry, and other points at issue are also dealt with, the final chapter on superstitions disposing of some amusing ideas and providing a little light relief. There can, of course, be no question of Wriedt's contribution to the subject and his book should be of great service to breeders who wish to bring their knowledge of the subject up to date.

Further Illustrations of British Plants. By R. W. Butcher: drawings by F. E. Strudwick. Pp. 476. L. Reeve & Co., Ltd., Ashford, Kent, 1930. Price 12s.

This well prepared volume forms a supplement to Bentham's ***Handbook of the British Flora***, which has passed into a seventh edition (1924). It contains black and white figures, with dissections, of 485 British plants, the vast majority of which are not represented in

Fitch's *Illustrations of the British Flora*, fifth edition (1924), and are not available in any other single volume dealing with British plants. A brief description accompanies each plate and gives the essential specific characters. The choice of species for figuring within a single volume of limited size seems to have been well made and the drawings are, with few exceptions, excellent as a means to identifying those more critical species which were not recognized or taken up by Bentham. The author and his artist are both to be congratulated on producing a most useful work, which should stimulate interest in the detailed study of our varied flora.

The Pig Breeders' Annual for 1930-31 and Year Book of the National Pig Breeders' Association.—Pp. 148. (Published by the Association, 92 Gower Street, London, W.C.1. Price 2s. 6d. net.)

The present volume completes a decade of the life of this Annual, and its contents are as varied and interesting to the breeder as they have been in the past. Lord Noel-Buxton contributes a foreword to this issue, which contains a great deal of useful information on feeding and on the industry in some foreign countries and in New Zealand. Amongst others an article by David Black on "The Future of Co-operative Bacon Factories in England" is worthy of mention. Diseases and their treatment are also dealt with, and some of the general aspects of the industry in their commercial relations are also covered, while an interesting article on its history and development is contributed by Dr. A. G. Ruston, under the title of "Pig Keeping, Ancient and Modern." The number and variety of the articles contained in this issue prohibits anything like a complete indication of the contents, but readers of this JOURNAL will, no doubt, already be familiar with the general character of the Annual, and, if they are engaged in pig breeding, satisfied that it should prove useful to them.

The English Plough. By J. B. Passmore, M.Sc. Pp. 84. Illustrated. Reading Univ. Studies. (London: Oxford University Press. Humphrey Milford, 1930. Price 7s. 6d. net.)

This is an outline of the history of the development of the English plough, written by the lecturer in agricultural engineering at Reading University, and is the first special study of the subject which has appeared. There are histories of the plough in general, and it has, of course, been treated of in all the general histories of English farming; but this brief monograph should be useful to the student of agricultural engineering because it provides an historical background to his studies of the modern technique of plough manufacture and the practical use of the implement. The book is divided into four sections, dealing with the "Development of the English Plough," "Descriptions of Ploughs," "Construction of Ploughs," and "One-Way Ploughs." Only the main types of improvement are dealt with and there is no mention of any but the single furrow plough, while the only writers on plough design of the 18th century who are mentioned are Arbuthnot and Small. It is to be regretted that the references are usually incomplete, lacking volume and page numbers; nor is the author adequately equipped to deal with the historical development of the plough. But few of his readers are likely to seek for guidance on historical questions. For students of modern agriculture these will be minor deficiencies and the book will undoubtedly serve a useful purpose.

The Transactions of the Yorkshire Agricultural Society for the Year 1929, No. 87. Edited by the Secretary to the Society. Pp 132, 12, 47. Illustrated. (York: Published and sold only by the Society at New Street Chambers. Price 5s.)

This Annual contains some twenty items and it is only possible to note a few of them. Several of the contributors are, however, well known to readers of this JOURNAL and are acknowledged authorities on the subjects upon which they write. Professor Hanley deals with "The Formation of New Pastures," Professor Gaiger with "Grass Disease," and Dr. Crowther, with "Feeding the Bacon Pig." Other interesting contributions are those by Sir Alfred E. Pease, Bart., on "Blackface Sheep, their Origin and History," J. K. Thompson on "Dried Sugar Beet Pulp—its Value and Use," and R. McG. Carslaw on "The Effect of Size and Shape of Fields on Costs and Profits." The other items are also of interest, and from Appendix B it is learnt that this flourishing Society has a membership of some 3,562.

A Survey of Milk Marketing in Derbyshire, June, 1928. By F. J. Prewett. Pp. 70. (London: Humphrey Milford, Oxford University Press. 1930. Price 2s. 6d. net.)

The author of the present survey has given us two earlier works on the subject, one of which is *The Marketing of Farm Produce: Vol. II., Milk* (1927), and the other *A Survey of Milk Marketing, based on conditions in Wiltshire and Somerset and the City of Bristol, June, 1927* (1928). The latter deals with an area which is mainly dependent on distant markets, and includes cheese-making as a feature of its dairying industry. The work under notice refers to a more industrialized county, surrounded by large towns, where the main activity of dairy farming is centred on milk selling. It may, perhaps, be added that Derby was always largely a grazing county, but that, before the era of railway transport, local sales of milk prevailed, while butter and cheese, less perishable and more valuable in relation to bulk, were exported from the county.

After a careful survey of the conditions of marketing of milk in Derbyshire, Mr. Prewett comes to the conclusion, *inter alia*, that, with such a diversity of marketing methods in the county, competition among producers for a liquid market is inevitable. The producer, he suggests, must, therefore, organize on some basis that will give him power over the methods of distribution and the right to insist upon information as to the quantities relatively distributed, liquid and manufactured. For this purpose he indicates that the organization known as the "Pool" would be effective.

Such surveys as this of Mr. Prewett's and his earlier work are useful in so far as they describe the position of a branch of the farming industry in a particular place at a point of time. In order to give full consideration to the situation in the country, and, if necessary, to the possibility of its improvement, they need, however, to be correlated with a general survey, which is not always available, but which, in the case of fluid milk, has been provided by Mr. R. B. Forrester in *The Fluid Milk Market in England and Wales* (The Ministry's Economic Series No. 16).

It may, perhaps, also be suggested that the provision of a slight historical introduction would be an advantage in showing how modern conditions have arisen, and that it would not be necessary for this purpose to go further back than the County Reports of the old Board of Agriculture which were issued about the end of the eighteenth century, and to supplement these by the prize essays on different counties to be found in the Journal of the Royal Agricultural Society.

The History of the Corn Laws, 1660-1846. By Donald Grove Barnes. Pp. xv. + 336. (London: George Routledge and Sons, Limited. 1930. Price 15s. net.)

A comprehensive history of the English corn laws has long been a desideratum for students of economic history; and besides the history of the legislation a study of the repercussions of the laws upon the

production and trade in wheat and the other cereals would have been an additional advantage. Professor Barnes has confined himself almost exclusively to the laws and the pamphlet literature of the controversies that preceded and followed them, a sufficiently arduous and comprehensive piece of work perhaps, and one that forms a very welcome addition to the sum of historical knowledge. It is, indeed, almost impossible to define the effect of the eighteenth century laws upon the farming industry, because many of them did not effectively carry out the aims for which they were formulated; moreover, the industry and the trade in its products were subject to many other, possibly more potent, influences than those of the legislation, and these are so closely interrelated that they cannot be separated and estimated individually.

The most important of these influences were the inclosure and redistribution of a proportion of the land farmed under the open field system, and the inclosure of some of the waste, which affected the area under cereals and the yield obtained from this area, thus providing an exportable surplus or increasing the supply sufficiently to enable the requirements of a growing population to be met without undue dependance upon importation until well into the nineteenth century. For his discussion of this factor Professor Barnes is, however, content to depend upon secondary authorities, and this is comprehensible in the light of the aims and scope of the book.

By most of the modern writers on the different phases of agrarian economy in the eighteenth century the year 1765 has been taken as a dividing point between the period of exportation and that of importation of cereal foodstuffs. By some, the earlier period has been regarded as the golden age of British agriculture, particularly for the wheat grower. Professor Barnes thinks that this view may reasonably be regarded as exaggerated, and equally that the effects of agricultural improvements on the production and exportation of grain during that time may be over estimated. It is true that the effect of these improvements was slight before 1760 and only fully developed in the nineteenth century. Professor Barnes does not, however, fail to apply the epithet "vast" to the improvements he thinks may be easily exaggerated. "The first half of the eighteenth century," he says, "is well known for its improvement in stock breeding, rotation of crops, manuring and draining. Much of the advance must be ascribed to pioneers in these fields." It must, however, be remembered that Young himself said in the *Annals* for 1784 (p. 95) that the improved farming of Norfolk, Suffolk and Kent was confined to very narrow limits.

A surplus of grain, above the requirements of the localities in which it was grown, had indeed been secured in the seventeenth century, and that was, as Professor Barnes admits, one of the reasons for the passing of the Act of 1689. It is probable that this Act had some effect in stimulating the growth of grain between 1689 and 1765, but it is doubtful if the law was more important than the more rapid growth of population, which affected the development of cereal cultivation so much more markedly in the last decades of the century and in the first four of the nineteenth. Other elements also played their part in determining to what uses the soil should be put, and not the least of these was its own suitability for grain or grazing, a fundamental quality that no intelligent farming community can ever fail to overlook.

Professor Barnes has definitely confined himself to the corn laws after 1660, the era previous to that date being disposed of in a single brief chapter, and this is doubtless because the modern period is one that involved external as well as internal trade, and the laws in the main aimed at the regulation of the foreign trade, with the idea of maintaining

the home supply at a sufficient level. The extraordinarily comprehensive bibliography shows how thoroughly the work has been done, and the book takes its place as the most comprehensive study of the subject which we yet possess.

Animal Breeding. By Laurence M. Winters. Pp. x. + 389. Illus. (New York, John Wiley & Sons, Inc. London, Chapman & Hall., Ltd. 1930. Price 18s. 6d. net.)

This, the second edition of Professor Winters' book, has been rewritten. Its author is Animal Breeder and Associate Professor of Animal Husbandry in the University of Minnesota, and in this edition he has endeavoured to make the text more comprehensive, to correct any errors there may have been in the first edition, and to include much of the recently published work relating to the rapidly extending subject of animal breeding.

As he says, animal husbandry is the foundation of successful agriculture; and animal breeding is the beginning of all animal husbandry. It is, therefore, one of the most important agricultural subjects. Moreover, the population of the world is increasing rapidly and a much larger supply of food will be required within an appreciable length of time. Although the *per capita* consumption of animal products in some countries may diminish, the total quantity used in the world will increase tremendously. Animal husbandry is thus a matter of vast importance not only from the point of view of the farmer, but also to the world at large.

The practice of animal breeding is very old, but the science upon which it rests is very young. Consequently each of the past few years has produced valuable contributions to the subject, and the author has made it his object to select those contributions, whether old or new, that seem most valuable, and to incorporate them in his book. The fourteen pages of closely printed bibliography at the end of the book show how widely his net has been cast, and how easy will be the task of those who wish to use this book as a preliminary to pursuing the subject further.

As might be expected, the book has been prepared primarily for use as a text book for students at agricultural colleges and by their teachers. Professor Winters admits that the arrangement of the text will not satisfy all requirements, because the science of animal breeding is taught differently at different institutions, but he has endeavoured to embody the numerous valuable suggestions he has obtained from teachers who have been using the first edition of his book. It is perhaps unnecessary here to set out the contents in detail because they are sufficiently indicated by the title, but it will be enough to say that the arrangement of the main body of the work is in four parts—I. The Foundation, economic and biological; II. Reproduction; III. Heredity; and IV. The Practice—so that it covers the whole range of the subject.

Sugar Beet: Costs and Returns for the Year 1928-29. By A. Bridges and J. R. Lee. Pp. 50. (Oxford Agricultural Economics Research Institute, 1930. Price 1s.)

This pamphlet continues the series which has now been issued annually for some years, and presents further results of the Institute's inquiry into the financial and economic aspects of the beet sugar crop. The form in which the returns are presented may now, in the fifth year of the accumulation of these records, be regarded as stabilized, the dual classification of the costs, by soil groups and geographical areas, having been continuously adhered to. This procedure facilitates the comparison of the results year by year and renders the returns the more valuable.

The summary shows that while the area of beet and number of growers declined in 1928 as compared with 1927, the year was more favourable to the crop, and both yield and sugar content were greater than in the previous year. In neither year, however, were the factories working at full capacity.

Progress in English Farming Systems—II. The Improvement of Upland Grazings. By Stanley M. Bligh and F. J. Prewett. Pp. 36. (London: Humphrey Milford, Oxford University Press. 1930. Price 1s. 6d. net.)

Mountainous country is, of necessity, where it can be used at all, usually devoted to grazing, and Wales has always depended more upon its sheep and cattle breeding than upon any other branch of farming to supply its saleable products. Much of its grazing land has always been in a state of nature, but this small study definitely shows that a proportion of it at least is not unimprovable. Mr. Bligh himself, the landowner who is responsible for the work done on his estate near Builth Wells, estimates this proportion at between one million and a million and a-half acres in the Principality—or nearly one-half of the total of 3,100,000 acres of rough grazings and permanent grass not kept up for hay, which constitute three-fifths of the area of Wales. He also suggests that a further million acres of similar land in the West of England could be improved in the same way. Such optimism deserves careful consideration, especially when it is supported by the evidence of the very effective work Mr. Bligh has done on his own estate. His conditions, however, are peculiar, and it is doubtful if the system could be generally applied. For example, there is apparently a local demand for accommodation land, and family labour is the basis of the system. The system that Mr. Bligh has adopted so successfully is, of course, fully described in the booklet, and both occupiers and owners of land of this character should consider it carefully when they are about to attempt the improvement of this class of holding.

Progress in English Farming Systems—III. A Specialist in Arable Farming. By C. S. Orwin. Pp. 24. (London: Humphrey Milford, Oxford University Press, 1930. Price, 1s. 6d. net.)

This little book, scarcely more than an essay, deals with the life story of the farmer of the largest arable acreage in England, and sets out to show that the application of the results of scientific investigation to the practical problems of farming have resulted in what can only be described as a magnificent success. Mr. Orwin describes how Mr. Baylis purchased Wyfield Manor in 1875 with £15,000 of borrowed money, and how from that apparently inauspicious beginning he has built up holdings until he now farms an area of some 12,000 acres in the counties of Berkshire and Hampshire. Mr. Baylis, explains Mr. Orwin, set out to cultivate arable land for the purpose of selling off all the products, including the straw and hay, and for this reason dispensed with all live stock except the horses necessary for the farm work. His rotation was corn, fallow, corn, clover, corn, fallow, and fertility was maintained by the liberal application of artificials. It is interesting to note that while steam tackle is hired for ploughing on Mr. Baylis' many farms, he has not yet adopted the use of the tractor, all his other work being done by a large number of horses.

The Seasonal Distribution of Farm Labour Requirements. By W. H. Kirkpatrick, C.D.A. (Glas.), Dip. Agric. Econ. (Cantab.). Univ. of Cambridge: Farm Economics Branch. Report No. 14. Pp. iv+44. (Cambridge: W. Heffer & Sons, Ltd. 1930. Price, 2s. net.)

In presenting a study of the labour requirements over a period of two years on a number of sample farms in the Eastern Counties, the writer emphasizes the fact that labour costs form an increasingly large proportion of the total costs of the farm. He estimates that labour is roughly twice as expensive to-day as in pre-war years, while the farmer's produce is fetching less than one and a-half times as much. Even allowing for an increased production per worker, the incidence of the higher cost of labour bears heavily on the industry. It is unlikely that this state of affairs will be remedied by the reduction of wages (which in any case would be undesirable) and consequently the difficulty must be dealt with by the more efficient organization of labour and a consequently enhanced output per unit. It is with the object of assisting in such organization that this study has been published. The author has had access to the labour records for the two years 1927 and 1928 of twelve fully-costed farms distributed throughout the counties of Cambridge, Essex, Hertford, Huntingdon, Norfolk and Suffolk, and this sample, representing twenty-four farming years, has been found to be generally statistically representative of the normal conditions in the Eastern Counties.

The distribution of labour, both manual and horse, is analysed very closely and is illustrated with a number of graphs and tables, the results being fully discussed. The author admits that his conclusions can only be regarded as tentative and that there are many other problems of an allied nature which need to be investigated before final conclusions of a practical character can be formulated which will enable the farmer to organize his labour so that it will be employed on profitable work to the maximum throughout the year. This report, however, represents a beginning, and a promise of a fuller consideration of the organization of agricultural labour in the Eastern Counties is made for the future. This will no doubt come to hand when a much larger body of data has been collected and examined.

The Weather Map: An Introduction to Modern Meteorology. Second Edition, entirely re-written. The Air Ministry Meteorological Office. Pp. iv+83. Illustrated. (London: H.M. Stationery Office. Price, 3s. net.)

The first issue of this publication appeared in 1915 and frequent reprints have been necessary since that date, the sixth being issued in 1925. The book has now been entirely re-written to meet the great advance made in synoptic meteorology of recent years.

As an introduction to the subject, an outline is given of the history of weather maps, which commenced with the end of the seventeenth century. Then follows a description of the various observations from which weather maps are prepared—temperature, pressure, wind force and direction, cloud types and height, visibility, etc. The weather generally associated with the different pressure systems is described, and the method of preparing forecasts is indicated.

As a practical illustration, twelve examples of forecasts are appended with copies of the weather maps upon which they were based, and notes indicating the reasons which led the forecaster to his decision.

Factors Affecting the Price of Potatoes in Great Britain. By Ruth L. Cohen, B.A. Univ. of Cambridge: Farm Economics Branch Report No. 15, pp. 55. (Cambridge: W. Heffer & Sons, Ltd. 1930. Price 2s. 6d. net.)

The growers have for some years found great difficulty in dealing with the sale of their crops of potatoes so as to obtain an adequate price covering their costs and providing an element of profit. The main cause of this has been assumed to be the fluctuation in yield to which this crop is specially liable, and the difficulty has been the more pronounced when the harvest has been so good as to make it almost impossible to sell the stocks at any price at all. This study of the factors affecting the price is the more welcome on this account.

After a careful consideration of the retail and wholesale prices of potatoes, and the conditions of the crop and its sale from the earliest time when the essential figures are available, Miss Cohen summarizes her conclusions and states that "The analysis thus indicates that little can be done to alter variations in supply, so long as fluctuations in yield continue. For such movements are not sufficiently regular for it to be possible to advise farmers to alter their acreage in the opposite direction to variations in yield."

"The farmer would gain if prices were rendered more steady intra-seasonally. It has been shown that, in general, farmers and dealers seem to be unwilling to recognize that production is either unusually high or unusually low. Hence prices do not rise for some time when production is small, or fall for some time when it is large. This tendency is more marked for a deficiency than for a surplus of production. So, in years when home production is low, imports enter the country in the later months of the crop year, and foreign producers get the benefit of the high prices in these months, while the English farmers sell the bulk of their crops at the lower prices prevailing earlier in the year. This tendency to miscalculation, though still in evidence, has recently become less pronounced. Its elimination, by the spread of information, would almost certainly benefit the British farmer."

Dairy Cattle: Selection, Feeding, Management. By William Wodin Yapp, Ph.D., and William Barbour Nevens, Ph.D. Illustrated, pp. xix+390. (New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd. 1930. Price 12s. 6d. net.)

The authors of this work are respectively Professor of Dairy Cattle and Associate Professor of Dairy Cattle Feeding in the Illinois College of Agriculture. The first edition was planned with the aim of making available to students of dairy farming and to dairy farmers themselves the most practical methods of selecting, feeding, and caring for dairy cattle. The methods recommended in the book were based upon the proved and tested practice of successful dairymen in the United States of America and upon the results of scientific investigation. The style is simple and concise, and the student and farmer can secure accurate information without an extensive search through scientific literature. The second edition has become necessary because of the more recent developments in the fields of animal breeding, nutrition, and physiology, which, it is claimed, are now incorporated.

As in all American books, forage crops which are not extensively cultivated in Great Britain are strongly recommended for the reason that they form the basis of successful dairy farming in the United States. Apart, however, from this, the work contains many features of use to students and dairy farmers in this country.

Wheat. By W. W. Swanson, Ph.D., and P. C. Armstrong. Pp. xiii+320. (Toronto: The Macmillan Co. of Canada, Ltd. 1920. Price 12s. 6d. net.)

This study of the conditions of wheat growing and marketing in Western Canada is written by the Professor of Economics of the University of Saskatchewan and a Consulting Agriculturist. It is a definite contribution to our knowledge of wheat production, and similar studies relating to the other great centres of cultivation would do much to elucidate many points now the subject of constant discussion. Methods of wheat cultivation and sale are of world-wide importance and can no longer be dealt with parochially, or according to the ideas of limited areas of demand and supply.

The one crop system of farming in Western Canada is very different from any type of agriculture practised in this country, and therefore

the book has little to teach us technically on this side. Moreover the making of a farm area from the wilderness in a brief space of time has caused a development in the community inhabiting the wheat belt different from anything that can be found in the older, more slowly created communities of Europe, where the present position has been arrived at only after the slow evolution of centuries.

The methods of handling the crop in Canada are fully described and the development of co-operative wheat marketing is traced. The rapid development after 1923, following on more isolated attempts at the co-operative ownership of elevators and of selling, is largely attributed to the strong community spirit in Western Canada and to the fact that inspection and handling have been developed to mechanical perfection. In the chapter on the wheat pools, the writers support the pool's claims to having benefited farmers and rendered marketing more efficient. But they, in looking to the future, see two dangers to the pool movement: the danger of pools becoming influenced by politics and of the agitations for compulsory pooling threatening the success of a voluntary organization. But the arguments for and against the compulsion of minorities are not treated in sufficient detail to convince the reader.

The lesson to be learned from Canadian conditions is one of marketing difficulties and how they have been tackled. From time to time notes have appeared in this JOURNAL about the Wheat Pool, and it is possible that some organization of this kind might be of service to British agriculture. It should be remembered, however, that the Canadian, no less than the British, farmer desires to raise the farm price of his produce and that he also is faced with the fact that wheat is ruled by a world price. Moreover the Canadian farmer is in rather a better position to sell advantageously because the major portion of his crop is grown from one type of seed and is, therefore, the more readily graded.

This readable book should prove valuable to the general reader.

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SELECTED CONTENTS OF PERIODICALS

(*List concluded from the* JOURNAL *for September*, 1930.)

Dairying and Dairy Products

The Inheritance of Milk Yield in Ayrshire Cows. *A. D. Buchanan Smith, R. J. Scott* and *A. B. Fowler*. (Jour. Dairy Res., I, 2 (May, 1930), pp. 174-179.) [575.1; 63.711.]

The Analysis of the Lactation Curve into Maximum Yield and Persistency. *H. G. Sanders*. (Jour. Agric. Sci., xx, 2 (April, 1930), 145-185.) [612.664; 63.711.]

Milking at Three Eight-hour Intervals as a Means of Investigating Variations in the Fat and Solids-not-Fat. *K. W. D. Campbell*. (Jour. Agric. Sci., xx, 2 (April, 1930), pp. 213-232.) [63.711; 63.712.]

Bacteriological Examination of Milk for Local Authorities in Wales. *P. M. Hickson* and *S. B. Thomas*. (Welsh Jour. Agric., Vol. VI (1930), pp. 265-278.) [576.8 : 7; 614.32; 63.712.]

Laboratory Work in connection with Butter Competitions. *S. B. Thomas*. (Welsh Jour. Agric., Vol. VI (1930), pp. 279-284.) [576.8 : 7; 614.32; 63.721; 63.726.]

A Preliminary Report on the Bacteriological Examination of Fresh Cream and Artificial (Reconstituted) Cream. *S. B. Thomas*. (Welsh Jour. Agric., Vol. VI (1930), pp. 284-289.) [576.8 : 7; 614.32; 63.712.]

Methods of Determining the Numbers of Bacteria in Milk. *A. T. R. Mattick.* (Jour. Dairy Res. I, 2 (May, 1930), pp. 111-135.) [576.8 : 7.]

Rusty Spot in Cheddar and other Cheese. II.: Factors Controlling the Pigmentation of the Causative Organism. *J. G. Davis* and *A. T. R. Mattick.* (Jour. Dairy Res. I, 2 (May, 1930), pp. 136-148.) [63.735.]

Pasteurized Milk for Cheddar Cheese-making. I.: A Preliminary Chemical Investigation. *G. M. Moir.* (Jour. Dairy Res. I, 2 (May, 1930), pp. 149-167.) [63.73 ; 63.736.]

The Comparative Trend of Prices of British and Imported Dairy Products. *R. H. Wynne.* (Welsh Jour. Agric., Vol. VI (1930), 109-116.) [63.723 ; 63.732.]

Poultry

The Maintenance Requirement of the Fattening Cockerel with a Note on a Proposed New Method for the Determination of the Surface Area of Birds. *B. A. Southgate.* (Jour. Agric. Sci., XX, 2 (April, 1930), pp. 206-212.) [612.394 ; 63.651 : 043.]

A Comparison of Shrimp "Bran" and Two Kinds of Fish Meal when fed at a Level of Ten per cent. in Diets for Growing Chicks. *H. W. Titus, E. McNally* and *F. C. Hilberg.* (Poultry Sci., IX, 4 (May 1, 1930), pp. 219-234.) [612.394 ; 63.60432 ; 63.651 : 043.]

Veterinary Science

Experiments on the Treatment of Parasitic Gastritis in Sheep and Lambs. *W. A. Wood.* (Jour. Agric. Sci., XX, 2 (April, 1930), pp. 186-205.) [59.169 ; 619.3.]

A Review of Undulant Fever. *J. Mills.* (Jour. Dairy Res., I, 2 (May, 1930), pp. 180-184.) [619 ; 619.2.]

Immunization of Fowls against Fowl Pox by Means of Pigeon Pox Virus. *T. M. Doyle.* (Jour. Comp. Path. and Ther., XLIII, pp. 40-55 (March, 1930).) [619.5.]

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NOTES FOR THE MONTH

Diseases of Animals Acts: Report for 1929

THE Report* on proceedings under the Diseases of Animals Acts for the year 1929 has now been issued. Part I of the Report describes the position of Great Britain with regard to animal diseases and gives the record of the outbreaks of scheduled diseases which occurred during the year. It shows the progress made in the reduction of cases of foot-and-mouth disease, sheep scab, anthrax, parasitic mange of horses and the notifiable forms of tuberculosis. It also describes the increased prevalence of swine fever during 1929 and the measures taken to deal with it. The section dealing with bovine tuberculosis contains a review of the results of the administration of the Tuberculosis Order of 1925 during the four years of its operation (1926 to 1929). Papers are also reprinted which were read by Sir Ralph Jackson, M.R.C.V.S., Chief Veterinary Officer of the Ministry, at meetings in Paris in June, 1929, of the International Office of Contagious Diseases of Animals, on :—

(*a*) The tenacity of the virus of foot-and-mouth disease under field conditions, and

(*b*) The introduction to Great Britain of anthrax infection by means of products of animal origin.

In Part II will be found a review of the administration of the measures taken to prevent the introduction into and spread of disease in this country, and for the protection of animals from unnecessary suffering during transit by land and sea; particulars of the animals imported from Ireland and other countries and the cases of disease therein; also a statement of the casualties which have occurred during the transit of animals.

Part III contains a brief summary of the diagnostic work done at the Ministry's Veterinary Laboratory at Weybridge in cases of certain scheduled diseases, including lists of the specimens received at the Laboratory for examination and

* *Report of Proceedings under the Diseases of Animals Acts for the Year* 1929. His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.2. Price 2s. net.

report. Research work is dealt with in separate reports or by contributions to scientific journals.

Part IV describes the working of the London Quarantine Station for pedigree stock intended for export to the British Dominions and Colonies, and gives particulars of work which is being carried out in connexion with the reduction of the warble fly pest.

The Appendixes to the Report contain the usual statistical tables of animal diseases confirmed in Great Britain during 1929 and of animals imported and exported, and in addition a table showing the incidence of animal diseases in European countries during the years 1928 and 1929, and a table showing the number and breeds of each class of pedigree stock exported through the London Quarantine Station during those two years.

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Conference of Imperial Bureau of Soil Science

THE Imperial Bureau of Soil Science, of which some account has already been given in this JOURNAL (Vol. XXXVI, No. 10), held it first Conference on soil science problems from September 16-18 at Rothamsted Experimental Station, Harpenden, with which it is in close association.

The promotion of personal contacts between soil research workers of the Empire is one of the Bureau's chief objects, and the first day of the Conference was accordingly made the occasion of the annual visit of Empire agricultural officers to the Station. The visitors, who included representatives from Australia, Canada, Ceylon, Gold Coast, India, New Zealand, Nigeria, Sierra Leone, South Africa, Straits Settlements, Federated Malay States, Sudan, Trinidad, Uganda and Great Britain, were entertained to lunch, after a tour of the farm during which the classical and modern experiment plots were demonstrated. After the luncheon the Conference was formally opened by the Rt. Hon. W. G. A. Ormsby-Gore, P.C., M.P., and later an inspection of the laboratories was made and the work of the various departments demonstrated in groups.

Serious Conference work began on the following day, when Sir A. D. Hall presided over a discussion on the present position of soil analysis. The first discussion, on the mechanical analysis of soils, was opened by Profesor G. W. Robinson (Bangor) with an account of his work in comparing methods proposed by the International Society of Soil Science.

Modifications in the technique of the methods and their application to tropical soils were dealt with in some detail during the course of the discussion.

Mr. A. W. R. Joachim (Ceylon), opening a second discussion on available phosphorus and potash in soils, gave a brief outline of the present position of the subject with particular reference to the reliability of laboratory tests for availability and the physiological methods of Mitscherlich and Neubauer, suggesting that more use might be made of data for exchangeable potassium as an index of potash requirements. Later in the discussion the more extended use of the physiological methods in this country was advocated ; and it was pointed out that on the Continent, particularly in Germany, farmers relied to a considerable extent on the physiological indications of the need for potash or phosphate dressings to the soil. Though soil fertility conditions in Germany were not the same as in this country, experiments there were proceeding on the right lines—from field experiment to the laboratory—whereas here the reverse held, resulting in a mass of laboratory data uncorrelated with field work. Following further discussion, it was agreed that more field and laboratory tests, carried out in parallel, were needed in this country.

The subject of soil reaction and lime requirement was then opened by Mr. P. E. Turner (Trinidad), who dealt with the correlation of soil reaction measurements with the state of saturation of the soil with lime. In the ensuing discussion, among other points, reference was made to the value of pH determinations of the soil as a diagnosis of soil fertility, especially in its bearing on the tolerance of specific plants. Sugar beet, for instance, was said to fail at a pH below 5·3.

At the afternoon meeting the Chairman, Dr. A. C. D. Rivett (Australia), opened a discussion on the work of the Bureau. Sir David Chadwick, Secretary of the Executive Council of the Imperial Agricultural Bureaux, referring to the need of unity among research workers of the Empire which presaged the inauguration of the Bureau at the Imperial Agricultural Research Conference of 1927, said that the financing of the Bureau from a common fund derived from contributing Governments marked a new departure in the constitution of the Empire. The work of the Soil Bureau for the year was then outlined by the Director, Sir E. J. Russell. In the general discussion that followed recommendations were made, many by overseas representatives, the object being to increase the usefulness and efficiency of the Bureau's

activities. At the close of a detailed discussion the proposal that the Bureau should hold a one-day informal annual Conference was adopted.

The morning of September 18, devoted to a discussion of soil survey work, with Sir Thomas Middleton as Chairman, began with an address on the soil resources of the Empire by Sir E. J. Russell, in which he said that no basis sufficiently broad to allow the comparative study of regions so widely scattered as those of the Empire had existed until recent years. The grouping of soils was determined by climatic and geological factors. Topographical features also played an important part; but as a first approximate generalization, similar climatic conditions might be said to produce similar soil types, and a tendency to form similar agricultural conditions. Slides showing the different types of farming conditions found throughout the Empire were shown in illustration of this. He then went on to say that a survey of the soil resources of the Empire would serve many purposes. It would inform the Governments of the Empire of the agricultural possibilities of their land. The information would be the best obtainable and would be subject to the minimum of guess work such as had weakened so many estimates of the past. Canada afforded admirable illustrations of the dangers of prophecy. For the last 35 years forecasts had been made, without adequate knowledge of the soils, of the probable limits of wheat cultivation, which, with one exception, had all proved to be false. Still more important, such a survey would focus attention on the possibilities of agricultural development of the Empire as a whole. In concluding, he said that among manufacturers of the Empire there was a general working towards mutual agreements to reduce unnecessary competition and over-production: the agricultural scientific workers of the Empire were now organized through the Agricultural Bureaux to pool their information and ensure the maximum result for their efforts. It remained to bring about an organized agriculture for the Empire, based on sound soil and agricultural surveys, to ensure the best use of Imperial resources.

A discussion on the position of soil surveys in the Empire was then opened by Dr. F. J. Martin (Sierra Leone) with a description of a survey undertaken by him which resulted in an extension of rice growing areas in Sierra Leone. Examples of similar extensions were instanced during the discussion. Sugar cane crops had been considerably extended in India through irrigation, by carrying out survey work which

distinguished between areas that would, or would not, respond to irrigation. The need for further work of that kind, especially in North-west India, and for the examination and correlation of official data already available, was stressed. Some accounts of the areas already surveyed in the Empire were then given.

In the next discussion, on the classification, mapping and profile examination of soils, opened by Dr. W. G. Ogg (Edinburgh), it was suggested that uniformity in the classification of soils could be furthered by discussions between surveyors of a large area at a central station; that there might be more extended use in survey work of aerial photography, which had been used with success in defining areas of sheep sickness in New Zealand; and that co-operation between soil surveyors and geologists is advisable.

The last discussion, on methods of field experimentation, presided over by Dr. P. J. du Toit (South Africa), began with an account by Dr. J. Wishart (Rothamsted) of plot lay-out in manurial experiments based on the statistical methods in use at Rothamsted. In further discussion he was able to put forward the advantages of the randomized block and latin square methods over the older systematic arrangements. Errors in the analysis of yield data in fertilizer experiments on cacao or coconut trees, due to lack of uniformity of seed or size of roots, were instanced, and this led to a discussion on the most suitable size of plot to be adopted for tree crops, and to the further question of eliminating errors in pasture fertilization experiments with grazing animals.

The first evening of the Conference was spent at a social gathering at Rothamsted, the second at a joint meeting of the British Empire Section of the International Society of Soil Science and the Soils Sub-committee of the Agricultural Education Association. Professor J. Hendrick (Aberdeen) deputized for Professor N. M. Comber (Leeds) at this meeting, when the Russian Soils Congress and the organization of the British Empire Section were dealt with in a partly informal discussion.

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Imperial Bureau of Mycology

THE Ministry of Agriculture desires that full use should be made by mycologists and plant pathologists in this country of the facilities offered by the Imperial Bureau of Mycology. This Bureau has been supported financially by contributions from the Governments of the Dominions, India, the Sudan, Iraq and most of the Colonial Dependencies. The British Government

has hitherto not made any financial contribution, its aid having taken the form of the provision of a Government building for use rent free by the Bureau. A new and more commodious building has been erected to house the Bureau, near the Herbarium at Ferry Lane, Kew, and arrangements are being made by which substantial financial aid shall be given in future by the three home Governments, which will enable the Bureau to extend the scope of its activities.

The Bureau is directed by Dr. E. J. Butler, C.I.E., F.R.S., D.Sc. For the purpose of dissemination of information it publishes the *Review of Applied Mycology*, which gives a monthly survey of all current literature dealing with phytopathology and economic mycology from every part of the world. Imperial Mycological Conferences are held, under the auspices of the Bureau, at intervals of five years. It undertakes the identification and study of fungus and bacterial plant pathogens; and it maintains a museum of tropical plant diseases and a lending library for the use of mycologists.

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World Agricultural Tractor Trials

THE World Agricultural Tractor Trials were held under the auspices of the Royal Agricultural Society of England, in conjunction with the Institute of Agricultural Engineering, University of Oxford. A report has been published of the results of the tests carried out by the staff of the Institute in connection with the trials.

The first section of the Report gives a full description of the methods by which the tests were conducted. A note on the general test on tractors follows, together with a brief account of the road test for which only two machines were entered. The tests of market garden cultivators are dealt with separately. In the final section of the Report an illustration and specification of each machine is given.

The tests of the tractor entries were carried out near Wallingford during the period June 2 to July 26. Only three machines failed to carry out the full programme. One machine was withdrawn owing to a change of arrangements on the part of the makers, and two on account of mechanical breakdown.

The object of the tests, and of the trials generally, was not to determine which tractor was the best in its class, but simply to show what each machine was capable of doing under normal conditions. The report is, therefore, confined to the actual results of the tests, together with notes on points directly connected with them. Any farmer contemplating the purchase

of a tractor must decide for himself which machine will best suit his purpose, having regard to the work which he will require the tractor to do and the conditions under which he would require it to work.

Public demonstrations of the machines tested took place on September 16 to 19 at Ardington, near Wantage.

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Beet Sugar Campaign, 1929–30

THE following is a summary of the revised results for Great Britain of the 1929–30 beet sugar manufacturing season as compared with the previous year. With the exception of acreage, which was exceeded only in 1927–28, the season was in all other respects, both from the agricultural and factory standpoint, the best on record. According to the preliminary returns for June 4, 1930, the acreage under sugar beet this year was estimated at 348,100 acres as against 230,553 acres in 1929, an increase of over 50 per cent.

	1929-30	1928-29
Acreage under sugar beet	230,553	178,047
Average yield per acre (tons)	8·7	7·7
Number of beet growers	32,204	25,050
Number of factories	19	19
Average number of days worked	91	72
Number of workers employed in factories during the campaign	8,854	8,172
Tonnage of beets delivered to factories ..	2,003,586	1,369,781
Average sugar content of beets (per cent.) ..	17·7	17·4
Average price paid per ton of beet.. ..	52s. 11d.	51s. 11½d.
Estimated total sum, including cost of transport, paid by the factories to the growers	£5,301,000	£3,559,000
Total production of sugar (cwt.)	5,841,489	3,904,172
Average extraction of sugar expressed as a percentage of beets delivered to factories	14·6	14·25
Average extraction of sugar expressed as a percentage of total sucrose in beets ..	83	82
Average farm output of sucrose per acre of beet grown (lb.)	3,440	2,995
Average factory output of commercial sugar per acre of beet grown (lb.)	2,837	2,456
Production of by-products :—		
Molasses (cwt.)	1,480,051	980,095
Pulp (Dry) tons	138,686	97,451
(Wet) tons	21,212	8,208
Subsidy paid :—		
Sugar	£3,794,288	£2,534,492
Molasses	439,488	290,328
Total	£4,233,776	£2,824,820

Production of Home-Grown Beet Sugar

ACCORDING to returns made to the Ministry by the beet-sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during September, 1930, together with the quantity produced during the corresponding month in 1929, was :—

	cwt.
September, 1930	198,575
September, 1929	11,905

The total quantities of sugar produced during the two manufacturing campaigns to the end of September were :—

	cwt.
1930/1931	198,575
1929/1930	11,905

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Winter Food Mixtures

THE following note on Winter Food Mixtures for Dairy Cows and Fattening Pigs has been communicated by Mr. J. K. Thompson, N.D.A., of the Agricultural Institute, Kirton :—

For Dairy Cows.—A good many inquiries are coming to hand relative to the use of dried sugar-beet pulp and home-grown grains in production mixtures for dairy cows.

A mixture designed to incorporate sugar-beet pulp which has been widely and successfully used in this area during the past two seasons is as follows :—

Decorticated ground nut cake	2 parts by weight.
Crushed oats	3 ,, ,,
Dried sugar-beet pulp	2 ,, ,,

The mixture is made up and fed dry at the rate of $3\frac{3}{4}$ lb. per gallon of milk.

In some cases where stocks of beans and cereals are held the following alternative mixtures are being advised :—

(*a*) Beans..	4 parts by weight.
Oats or wheat or both	2 ,, ,,
Barley, maize or sugar-beet pulp or all three	1 part ,,
(*b*) Decorticated ground nut cake	1 ,, by weight.
Oats or wheat or both	2 parts ,,
Beans	2 ,, ,,
Barley, maize or sugar-beet pulp or all three	2 ,, ,,

Feeding in each case at the rate of $3\frac{1}{2}$ lb. per gallon of milk.

For Pigs.—The following two tables give mixtures that have proved extremely successful in the feeding of store and fattening pigs, and which should meet the requirements of many pig feeders in this country.

For pigs over 4 months old and up to the finishing off period :—

	Mixture 1.	*Mixture* 2.	*Mixture* 3.
Extracted Soya meal..	$\frac{1}{2}$ cwt.	$\frac{1}{2}$ cwt.	$\frac{1}{2}$ cwt.
Sharps	$4\frac{1}{2}$,,	5 ,,	$5\frac{1}{4}$,,
Barley meal	5 ,,	$2\frac{1}{2}$,,	$1\frac{1}{4}$,,
	10 cwt. meal	8 cwt. meal	7 cwt. meal.
Cooked potatoes ..	nil	8 cwt.	12 cwt.

The mixtures 2 and 3 meet the requirements of those who have on hand chat and other unsaleable potatoes. Dried sugar-beet pulp may, if required, be used in these mixtures in replacement of some of the barley meal, but the quantity used should not exceed 20 per cent. of the whole ration, and where sugar-beet pulp is added the material is preferably fed dry, the dry system of feeding being adopted.

At Kirton it has been found that pigs will not take pulp satisfactorily if it is fed after previous soaking or in the wet system of feeding. Satisfactory results are obtained with it if fed as noted, and no trouble in any form has been experienced in feeding the pulp dry.

If the pigs are being carried on merely as stores, the potatoes may be fed raw, but where the pigs are being pushed on the tubers should be cooked. Unless the pigs have a free range the use of a mineral mixture in conjunction with these mixtures is advisable.

These mixtures may be used in the feeding of empty and in-pig sows in the first stages of pregnancy. In this case they should be associated with a free range or a mineral mixture. It should also be remembered that the total bulk of the ration must be reduced as pregnancy advances, and therefore the proportion of potatoes must be gradually reduced. The mixtures are not advised as suitable for use right up to the time of farrowing.

In the case of finishing pigs the table below indicates four alternative mixtures :—

	Mixture 1.	*Mixture* 2.	*Mixture* 3.	*Mixture* 4.
Barley meal ..	$6\frac{1}{2}$ cwt.	4 cwt.	$2\frac{1}{2}$ cwt.	1 cwt.
Sharps	$3\frac{1}{2}$,,	4 ,,	$4\frac{1}{2}$,,	5 ,,
	10 cwt.	8 cwt.	7 cwt.	6 cwt. meal.
Use with cooked potatoes ..	nil	8 ,,	12 ,,	16 ,,

Again dried beet-pulp may be substituted up to a limit of 20 per cent. of the total mixture. The potatoes are advisedly fed cooked to finishing pigs. For finishing pigs no mineral

mixture is necessary provided the animals have been satisfactorily fed in the earlier stages.

The mixtures given in both the foregoing tables represent cheap combinations, particularly where chat potatoes are available on the farm. As a point to be noted, however, it is assumed that the young pigs have been fed on a soundly-constructed ration before arriving at the age at which the use of the above rations can be recommended.

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Foot-and-Mouth Disease : Serum Inoculation

THE Ministry has had before it reports as to the experience gained in recent years in various countries where foot-and-mouth disease is endemic in the use of a new weapon for the prevention of the spread of disease, namely, the administration of serum treatment to animals which have been in contact with diseased animals or which have been otherwise exposed to infection.

Serum contains no curative properties, nor will it prevent the development of the disease in an animal which is already in the incubative stage. If, however, serum is administered to an animal which, although not itself infected, may be exposed to the danger of infection, experience abroad shows that it will afford protection against the disease for a period of about ten days in a high percentage of cases.

These results warrant a close examination of this subject in relation to actual outbreaks in this country, inasmuch as the temporary protection which may thus be secured to animals which are exposed to infection may be expected to :—

(a) diminish secondary outbreaks in the immediate vicinity of the original centre, and thus limit the number of foci to be dealt with ;
(b) reduce the number of animals which it is necessary to slaughter for the purpose of preventing the spread of disease, and
(c) at the same time reduce the areas over which it is necessary to impose restrictions upon the business of farmers and livestock salesmen.

In these circumstances the Ministry decided to apply serum treatment to a number of outbreaks in which the circumstances are favourable, and on September 19 made an Order making provision for this purpose. In the first instance this procedure will be of an experimental character and the results will be closely examined before the question of the adoption of serum procedure as a general rule is considered. During the progress of this experiment the slaughter policy which has been the means of eradicating the disease from this country for many years will remain the basic policy.

A BIOLOGICAL WALK IN WINTER

Sir J. ARTHUR THOMSON, M.A., LL.D.,
Emeritus Professor of Natural History in the University of Aberdeen.

IN northern or southern countries winter means, for familiar astronomical reasons, a great reduction in the supply of light and heat that the earth receives from the sun. This primary difference between winter and summer has associated secondary differences, such as the shorter day (in which plants and animals can do their work) ; various conditions, such as lessened evaporation and the binding of the earth with frost, which greatly hinder the circulation of water (the meteorological cycle, as it is called) ; the fall of snow with its many benefits and many risks ; also severe storms and so forth.

We all know, more or less, what is meant by winter—the annual recall of the Ice Ages of the past, oftenest ages of severe sifting, but occasionally of progressive effort.

Life at its Low Tide.—If we take a biological walk in summer, when life has its high tide, our difficulty often is that there is too much to see. The stage is crowded ; there is a bustle of life in hedgerow and meadow, in pond and shore.

In winter, however, there is often relatively little to see, unless we have plenty of time and more than an everyman's knowledge of where to look for the creatures that are in hiding. Often, especially in the north, we must be content to see two or three things each day, which gradually combine into our winter-picture. We envy those who are able, through long patience and practice, to tell us whose are all the footprints on the snow ; where the hedgehog is lying in his winter-sleep ; what winter-visitor birds have come to the estuary ; where the frogs are ensconced stiff and stark, mouth shut, nose shut, eyes shut, hardly breathing at all ; where the bats are hibernating, hanging head downwards by their toes and wrapped up in their leathery arms ; and so on.

We went one day into the Californian Desert with a naturalist who knew it well, and we had not been there five minutes before he said : "Do you know the lizard called *Xantusia* ? There's a species here that lives under the loose bark of the Joshua tree, hunting for spiders and other small fry. There's just the sort of place where it lives." Whereupon he laid his hand on the loose bark of the tree in question (one of the Yuccas, a sort of tree-lily), and produced a much startled Xantusia ! It looked like magic, but it was only a

vivid instance of that observational skill which all of us can in some measure attain along some line or other. It certainly adds to the joy of life.

Life Lying Low.—Winter is *a time of lying low*, as in the snails shut up in their shells far in the recesses of that old wall. Below the level of the shell opening, there is a lid of hardened lime and slime, with a small aperture through which an interchange of gases takes place. The snail itself is in a somewhat collapsed state, for its heart is beating very, very feebly, and the tissues of one that we dissected were distinctly under par, worse than flabby.

Before we pass the old wall we must pay tribute of admiration to the lichens which are spreading in strange orange-coloured patterns over the stones. Does life ever endure under greater difficulties—exposed on the surface of a wall? Fine threads insinuate themselves into microscopic crevices and absorb dissolved salts; the coloured part of the lichen absorbs air and the green cells build up carbon-compounds, just as in any ordinary green leaf. The secret of success is partly this, that every lichen is a combination of two quite different plants—a green alga and a colourless fungus, which work into one another's hands (symbiosis) and prosper. In the circulation of matter that is always going on in the world, these lowly lichens play their part, for they begin the weathering of the rocks, and we find them at work on the tops of the hills, making a primitive kind of soil which is eventually carried by runlets and streamlets to the distant valley and the farmer's fields.

Life in Hiding.—If you have time to rest on the wall, it is interesting to pull off some of the low-growing moss, which flourishes in the soil that the lichens have made, added to, no doubt, by dust-particles blown upwards from the road and carried down by the rain, helped also, of course, by the dead bodies of small creatures, both animals and plants, which bacteria have decomposed. When we uproot some of the mosses (to be packed into a hole when we pass on), we disclose a Lilliputian world, which a lens helps us to scrutinize. There are the tiniest snails and just visible worms, there are miniature insects and their larvæ, also some very interesting primitive wingless insects and some old-fashioned millipedes. We were pleased to find an old friend called *Orthesia*, a squat ca'canny insect, with a wax-white trailer behind its body, and this was full of developing eggs. Ever so much smaller, of course, are the microscopic animals of the primitive soil of the wall

crevices. With these there are few of us who can do much, but it is worth while to select a hundred yards of old wall and chronicle, week after week, the plants and animals that we can find on it, without including those that we cannot see with the naked eye. We soon discover that life is much more abundant—even in winter—than we at first suspected.

Suspended Animation and Winter Sleep.—Among the many different forms of "lying low" in winter we must include:—

(*a*) the relapsed life of some insect pupæ, where the body of the larva (*e.g.* maggot) has become greatly simplified in structure, in fact almost embryonic again;

(*b*) the arrested development of other insect larvæ, such as caterpillars and pupæ, where the metamorphosis into the winged form has ceased for the time being, like a stopped watch;

(*c*) the suspended animation of many small creatures, like Bear-Animalcules (some of them quaintly like microscopic hippopotamuses) and Wheel-Animalcules and small thread-worms, in which we can detect no vitality for the time being;

(*d*) the comatose state of snails and frogs, where we can see the beating heart, though the life of the body as a whole is at a very low ebb; and

(*e*) the state of true hibernation, restricted to a few mammals, such as hedgehog and dormouse, marmot and bat. Unlike ordinary warm-blooded mammals, and birds too, which are able to keep up the same body-temperature year in and year out (which is what warm-bloodedness means), the imperfectly warm-blooded types, such as the four mentioned, are unable to produce enough of animal heat to make good what they are losing in the cold weather. So they sink back into a peculiar state, very unlike normal sleep, with most of the vital functions (even excretion) in abeyance, with the heart beating very feebly and the breathing movements scarcely perceptible. This relapse into reptilian cold-bloodedness (and mammals evolved from an extinct Reptile stock) would soon be fatal in the open; but it is linked to the instinct to seek out a sheltered nook, where the temperature soon rises a little above that outside, and the retreat is warmed enough to keep the blood of the winter-sleeper from freezing.

Shelters and Retreats.—Along with the lying-low solution we must include the discovery of shelter, and this habit accounts in no small part for the bareness that marks our country walk along the path, through the copse, across the stretch of moor, and along the river-side. There are many

more animals than we see; they are hiding in shelters difficult to find. We split up 12 hemlock stems with a knife, and found 12 animals right away! In some cases, to be sure, the shelter is not here, but far away; and this brings us to the migration solution—conquering the winter by evading it. As we skirt the low moor we see some white hares scampering; they have put on a white dress which economizes the loss of heat and may also provide a cloak of invisibility against a background of snow; but the point just now is that these Variable Hares have migrated from the high hills, where the food is too deeply covered by snow, to the low grounds where they run an obvious risk from conspicuousness, but none of starvation. So the reindeer migrate in Newfoundland, and the majority of our British birds seek the south.

Where the river joins the sea we may be lucky enough on our walk to discover a Little Auk, a Great Snipe, a Northern Diver, or some other "winter visitor" bird, which finds our shores quite genial compared with the severities of the Arctic breeding-places frequented in summer. On the links we met a flock of Snow Buntings, singing in their flight, just arrived from across the North Sea, and making for the fields where they may refresh themselves with seeds after their long journey. Those of us who live in the North of Scotland sometimes find it a little difficult to believe in creatures that choose our country for winter-quarters!

Retrenchment.—As we stroll along the river, which has ice at its edges in many places, we notice the scarcity of life; and this strikes us most in regard to certain flood-pools or miniature ponds which we know to be teeming with animals in the summer. Most of their tenants are in hiding, and we feel a deep-down gratitude that water has the almost unique property of expanding as it freezes. Its maximum density, when the molecules are most closely packed, is at 4° Centigrade, and if the temperature falls further, towards the freezing-point or zero, the volume increases and the freezing water rises to the surface of the pool, where it forms a blanket of ice. Thus in winter the temperature at the floor of the pool is higher than at the surface; it is, therefore, difficult for the pool to freeze solid; and this means a very important conservation of aquatic life during the cold months in northern and southern latitudes. Some one should write a panegyric of water!

Our walk takes us through a little wood, including some fine beech trees, and the crickle-crackle of the leaves beneath

our feet reminds us of another way in which living creatures meet the winter—by retrenchment and by reduction of vulnerable surface. The leaves have worked hard all the summer, making carbon-compounds, and they must be in some measure worn out. After they have surrendered to the branches almost all that they have that is worth having, they are separated off and fall to the ground, where the earthworms bury some of them, thus adding to the invaluable vegetable mould, soon to be re-incarnated in the trees. So the world goes round; but our present point is simply that it pays most trees to shed their leaves in the fall. It is a useful reduction of vulnerable surface, for ordinary leaves that managed to continue with abundant water in their cells and vessels would run the obvious risk of having these ruptured by freezing.

The same retrenchment or reduction of vulnerable surface is seen in some zoophytes and even more complicated animals, but the adaptation is especially characteristic of plants. Yet we see it on a higher turn of the spiral when all the humble bees of the summer community and all the wasps of the nest die off in early autumn, except the young queens who alone survive the winter.

It is interesting to go back to one of the river-pools where the washed roots of the alder-trees and the bases of the bulrush stems are encrusted with the freshwater sponge. This was vigorous and distinctly green in summer, the green colour being due to countless numbers of microscopic partner-algæ, whose manufactured carbon-compounds help to feed the sponge; but now it looks rather the worse for wear. It is moribund, but all through its body there are clusters of cells forming microscopically beautiful gemmules, which live on and start new sponges in spring.

A Triumph of Weeds.—The corner of the moor looks rather fine in the winter sunshine which lights up the withered bracken. But, except æsthetically, we cannot approve of it, for the bracken is a disastrous weed, spoiling fine pasture-slopes and conquering even the heather. As we look at it we know of course that all that we see is dead; yet next year it will be more luxuriant and rampageous than ever. The secret is all too familiar, that the strong underground stem or rhizome is well-protected beneath the ground, and richly stored with nutritive reserves which will be mobilised in spring. So storing is another way of meeting the winter; and we can link the bracken to the squirrel with its stores of

beech-nuts in the wood—so different and yet the same in idea.

Man Following Nature's Lead.—As we come back again towards the farm, an interesting thought arose in our mind, that man often follows Nature more than he knows. Thus in regard to this problem of meeting the winter, many of the human solutions are closely parallel to Nature's. More or less unconsciously, similar problems find similar solutions. Many animals go into hiding or shelter; so man brings his cattle in some measure indoors. In the "black houses" of the Hebrides, the cow is brought, on the approach of winter, into one end of the crowded dwelling, for it requires less food indoors and is safe from storms. When spring comes, it has to be lifted out, so great is its weakness. So some species of ants take *their* cows—the green-flies or aphids—into an underground stable for the winter, and look after them too, till they can be carried out again in spring, for the day at least. In some cases the "vaccæ formicarum," as Linnæus called them, are taken into shelter every summer evening; and again we think of man ca'ing the cattle home.

The farmer provides for the winter by storing food, such as hay and turnips, for his stock, following the lead of the hamster with its chopped grass, the beaver with its cut branches, the squirrel with its beech-mast, the hive-bees with their honey, the Californian woodpeckers with their thousands of acorns firmly fixed in holes in the bark of oak-trees. Our fathers knew the change it meant when the extended cultivation of turnips made it possible to feed cattle and sheep in a satisfactory way throughout the winter, the farmer thus utilizing the plant's nutritive reserves for a secondary purpose of his own. In a way this is very elementary, but it is a thought worth pursuing, that man, consciously or unconsciously, has followed Nature in various solutions of the problem of winter.

We look into the stable and we see some of the more delicate horses well wrapped-up in horse-blankets, thus afforded the advantage which many wild creatures attain by thickening their coat of hair. How shaggy the domesticated Shetland Pony becomes in winter, just like the Yak amongst the snow on the Tibetan Uplands. At the end of summer the Swiss crofter brings his cattle and goats down from the "Alp" (as his high-level pasturage is called) and keeps them in shelter till the snows have gone—a device evidently paralleled by the migration of many birds and mammals.

We have spoken of the drastic elimination that is often characteristic of winter, and we can never forget one deadly

night of frost after which were gathered about two hundred dead birds (a big barrowful) from one farm steading. So man reduces his stock, sometimes beginning with those that are least promising of survival, but sometimes beginning with the best, in the hope of fattening up the others.

We need not pursue the Farmer-Nature analogy further, and we have too much respect for him and for ourselves to speak of the farmer hibernating, though there is an approach to this in some remote parts of Russia and Siberia when the inmates of the farm-house huddle together round the stove and do not really waken except at long intervals. Better than that would be another biological walk!

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RESEARCH AND THE BREEDING OF APPLES

(A Lecture delivered at the Bristol Meeting of the British Association)

Sir A. D. HALL, K.C.B., LL.D., F.R.S.,
Chief Scientific Adviser to the Ministry and Director of the John Innes Horticultural Institution.

YOU may wonder why I should propose to spend an important hour in talking about such a trivial subject as "apples." Apples are all very well, you think, as you help yourself to apple pie, but why cannot they be left to the gardener and the cook? Well, I chose the subject for two reasons, first because it affords a good illustration of how research, real research into fundamentals, the pursuit of knowledge for its own sake, suddenly begins to illuminate and direct the procedure of the practical man. Secondly, here in Bristol exists one of the most active agencies obtaining this sort of knowledge, the Fruit and Cider Institute at Long Ashton, of whose work Bristol citizens may well be proud. I am not going to tell you what Professor Barker and his colleagues are doing: they are better fitted to expound it themselves. I am going to take you into a remoter region of investigation, where some colleagues of my own are at present occupied. This is the way of science: we are all pushing against the boundaries of a universe that ends on all sides in obscurity. There is an area reasonably well lighted and with adequate communications, but which fades off in every direction into the unknown, and each worker or group of workers is trying to strike a path or clear a way into it. The paths are independent, but if the work is well done they all piece together eventually into a trustworthy map by which to walk.

development of the seed stops short, grow but a little way and then fall—causing the drop that is added to by apples which have been attacked by winter moth and the like.

Before leaving this process let me call attention to the fact that each of these seeds or pips is a new individual, compounded of the hereditary elements or characters derived from one or other parent. Each pip will give rise to a new variety, in the vast majority of cases distinct from both its parents and also from its fellow seedlings, though particular family identities can be traced. But when a new variety—a seedling individual—has been obtained, it can be multiplied indefinitely by vegetative propagation, in the case of the apple by budding and grafting, for few varieties of apple grow freely from cuttings. There are now millions of Cox's Orange Pippins in the world, but they must all be regarded as parts of that original raised by Mr. Cox in 1825, and they are all identical save for the very rare occurrence of a "sport."

Speaking broadly, fertilization is essential to the growth of an apple. It is not necessary that all the ten ovules shall be fertilized and mature as seeds; you will all be familiar with the fact that few of the apples you eat contain ten pips. In rare cases, depending both on the variety and on soil and season, a fruit will develop without fertilized seeds (a condition known as *parthenocarpy*), but from the practical point of view fertilization is necessary to ensure a crop.

Pollination Trials.—Let us examine a little more closely this matter of pollination. A number of trials have been made, some approximately and some under rigorous conditions of control, as by Mr. M. B. Crane of the John Innes Institution, on the efficacy of the pollen of different varieties in bringing about fertilization. It is found that apples, unlike the cherries and many plums, will normally "set" with pollen from other flowers of the same variety. The apple is generally self-fertile to some degree. The most notable example of self-sterility is Cox's Orange Pippin, and Table I, summarizing Mr. Crane's

TABLE I

	Flowers	*Fruit*	*Per cent.*
Cox's Orange selfed	1,950	13	0·7
Other varieties selfed	1,491	32	2·2
Cox's Orange crossed	941	53	5·6
Other varieties crossed ..	1,502	83	5·5

trials, shows how few are the fruits to be obtained from Cox's flowers which receive their own pollen. It shows also that other apples are more fruitful when crossed than when selfed. Not

a few cases have occurred of commercial failures to crop when Cox's has been planted in a block without admixture. Cox should always be interplanted with a variety like Worcester Pearmain, which flowers at about the same time.

Fig. 3 shows a photograph of an experimental tree of Cox. On certain branches the flowers have been pollinated with Cox pollen. They bear no fruit, whereas other branches, on which the flowers were cross-pollinated, bear freely. Why does Cox fail to set when it receives its own pollen? Careful examination shows that in such a case the pollen tubes begin to grow down the stigma, but stop at a certain point and never reach the egg cell. What may be the physical or physiological obstacle we do not know, though as we shall see later we can perceive an underlying cause.

So marked a case of sterility in apples as Cox's Orange presents is an exception, but there may be other latent causes of infertility in apple varieties which are usually masked because of the small proportion of flowers that need to be fertilized in order to produce a good crop. In a normal season an apple tree flowers abundantly, and if four or five per cent. of the blossoms mature into fruit there will be a heavy crop. Let us consider the seeds within the fruit, for seed production is the real measure of fertility; the number of fruits only measures fruitfulness when, as in the apple, an imperfect fertilization will result in a fruit. Table II shows the average of fruits and seeds produced by a number of pollinations in a particular year, first among what we shall for the present call normal varieties and then among three particular but well-known varieties, viz., Ribston Pippin, Blenheim Orange and Bramley's Seedling.

TABLE II

	Flowers pollinated	*Fruits set*	*Good seeds*	*Good seeds per fruit*	*Good seeds of flowers pollinated*
Normal varieties intercrossed	1,740	109	313	3·0	18·0
Ribston, Blenheim and Bramley x normal pollen	279	19	30	1·6	10·8
Normal varieties x Ribston, Blenheim or Bramley pollen ..	354	23	4	0·2	0·5
Ribston, Blenheim, Bramley intercrossed	170	6	7	1·1	4·1

It is clear that these varieties, Ribston, Blenheim and Bramley, are highly sterile, either as seed parents or pollen parents. They are not less fruitful than the normal varieties, but they are approximately one half as fertile when seed formation is

taken as the measure of fertility. In the first place this may be correlated with the interesting fact that with these three varieties less than 30 per cent. of the pollen is "good," *i.e.*, will push out pollen tubes when placed upon a suitable growing ground, whereas with the normal varieties 90 per cent. or more of the pollen is "good."

Cell Growth and Heredity.—Every plant is built up of cells which have all proceeded from the one original cell formed by the union of pollen and egg-cell. Within the cell is a small particle called the nucleus, and at the appropriate times this nucleus may be seen to contain a number of threads, about a fifteen-thousandth of an inch in length, called the chromosomes. For each species there is a definite number of chromosomes, and very often the number and to some extent the shape of the chromosomes is the same for all species of the genus. These chromosomes are all-important because they are the bearers of the hereditary factors and govern every character of the growing plant. One particular chromosome, for example, will determine whether the flowers are white or red, another whether the plant shall be tall or dwarf, etc. Growth proceeds by simple division of the cells, in which process the chromosomes split along their length and one-half of each proceeds into each of the daughter-cells. In consequence both of the new cells are exact repetitions of the old cell. This accounts for the identity with the original of all individuals produced by vegetative propagation, *i.e.*, by cuttings, layers, runners, buds and grafts, and bulb offsets.

In the normal cell the chromosomes are in pairs, either identical or, if different, yet having the same function and governing the same characters in the plant, *homologues* as we call them. In the sexual organs of the plant, special cells are formed, by suppressing one member of each homologous pair of chromosome in a vegetative cell. Thus if we represent a 14-chromosomes-nucleus of a vegetative cell as AA BB CC DD EE FF GG, the nuclei of the pollen cells and of the egg cells will be A B C D E F G. Thus when sexual union takes place between two identical individuals, ABCDEFG of the pollen cell unites with ABCDEFG of the egg cell and a new AA BB CC DD EE FF GG, identical with the original parent cells, is reproduced. The cells with the double set are called diploid, those with the single set haploid. When sexual union takes place between different species or varieties (cross-breeding or hybridization) we begin with differences in one or more chromosomes of the parents. One may be AA BB CC DD EE FF GG, and the other AA Bb CC DD EE FF GG, and consequently the new cell will be AA Bb CC DD EE FF GG, and the new plant will be hybrid as regards the characters carried by the B and b chromosomes. For example, BB may determine the flower colour to be red while bb makes a white flower. The hybrid Bb may have a pink flower, but very generally one or other of the chromosomes is dominant, and Bb will be red like BB. But the hybrid nature of Bb will come out in the offspring of Bb plants, because some bb plants will be produced and are white. This is the ordinary Mendelian segregation in the second generation into dominants and recessives in the proportion of three with the character of the dominant parent and one with the character of the other.

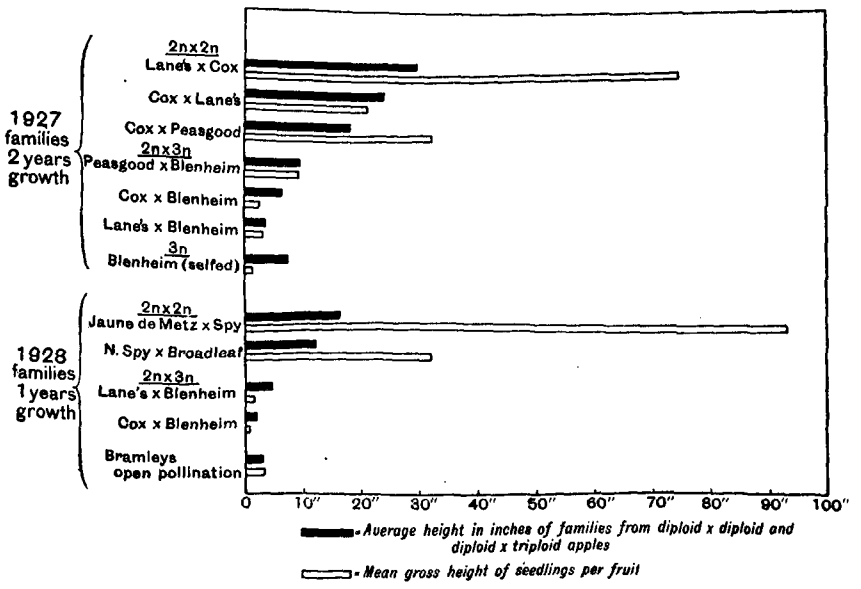
Such is the usual mechanism of the process of growth and reproduction, but very occasionally an abnormal cell is produced. For example, a vegetative cell will split its chromosomes and yet fail to divide, but remain as a cell containing 4 instead of the proper 2 sets of chromosomes. This cell then behaves like a typical diploid cell and gives rise to a shoot that has its chromosome sets doubled in both vegetative and reproductive cells. This shoot can be cut off and grown as an independent plant—really a new species, called a tetraploid, the double of the diploid from which it started. Such tetraploids are often giant forms of the original plant, because with the doubled number of chromosomes comes a larger cell and a plant larger in all its parts. The big Campanula "Telham Beauty" is a tetraploid of *C. persicifolia*, the giant Chinese Primulas are tetraploids, but this gigantism does not always accompany the tetraploid plant.

Again, tetraploids have in rare cases arisen through the union in sexual reproduction of two cells which have not undergone the usual reduction process into haploid cells. When a tetraploid breeds with a normal diploid the resulting hybrid will be a triploid with three sets of the type number of chromosomes.

The interesting point about these abnormal cells is that they are not infrequent, and among cultivated plants have indeed contributed to bringing about their economic value. Wheat and oats are hexaploids with six sets of chromosomes, and among the fruits such multiple structures are common and have caused many of the peculiarities in their behaviour which have hitherto been inexplicable. Such plants with various multiple sets of chromosomes are called polyploids.

Returning to the apples, it has been found that most varieties are diploids containing 2 sets of 17 chromosomes, but that a few are triploids with a total of 51 chromosomes in the nucleus. Among the triploids are those very three varieties—Blenheim Orange, Bramley's Seedling and Ribston Pippin—which possess a reduced fertility and give rise to fewer seeds whether used as male or female parent. These seeds, even when they will germinate, give rise to abnormal plants of very deficient vigour. Table III shows a comparison between diploid and triploid apples both as regards the number of living seeds per apple and the vigour of the plants grown from the seeds, measured by their height in their second year. The seedlings from the triploids are few in number and miserable in habit.

TABLE III



The photograph, Fig. 4, shows parallel rows in the nursery of such seedlings from triploids and diploids. The reason is plain enough now we are aware of the chromosome outfit. Seed formation is the outcome of sexual union, preceded as we have seen by a reduction division which halves the number of chromosomes in the cell. The halving consists in the selection of one member from each pair of homologous chromosomes, but symmetrical division becomes impossible when not a pair but a trio of homologous chromosomes has to be halved. When a diploid apple is crossed with pollen from a triploid, the egg

FIG. 3.—Experimental tree of Cox's Orange: branches on the left crossed with Summer Pippin, those on the right selfed.

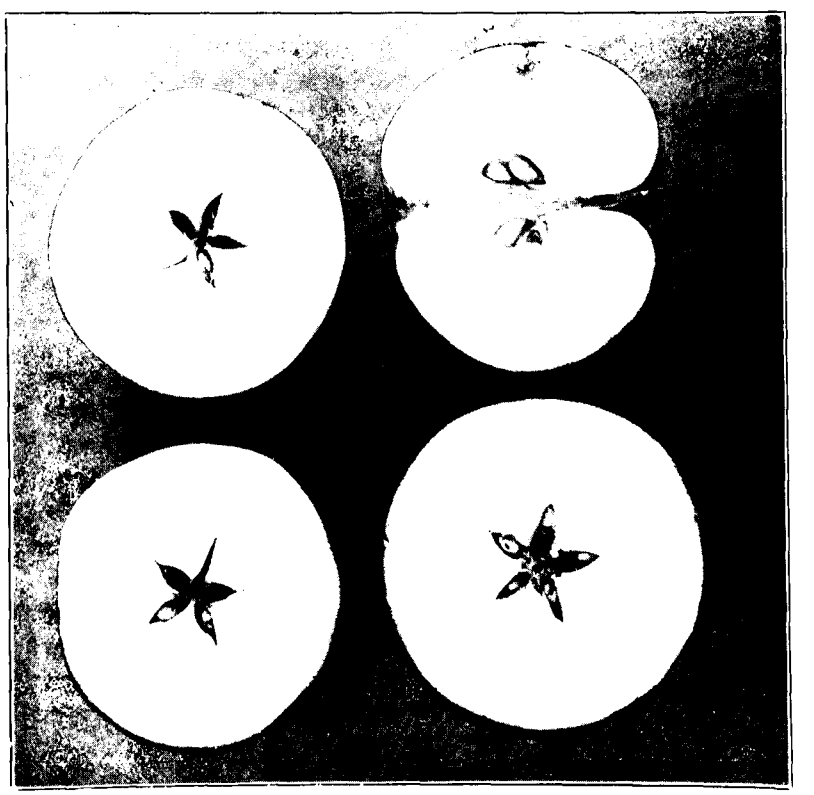


FIG. 2.—Apples in section, showing the structure of the fruit.

To face page 772.

FIG. 4.—Nursery rows of apple seedlings, 2 years old. The row of tall plants on the left, and at the further end of the right hand row, are from normal diploids; the rest of the right hand row (dwarf plants) from triploids.

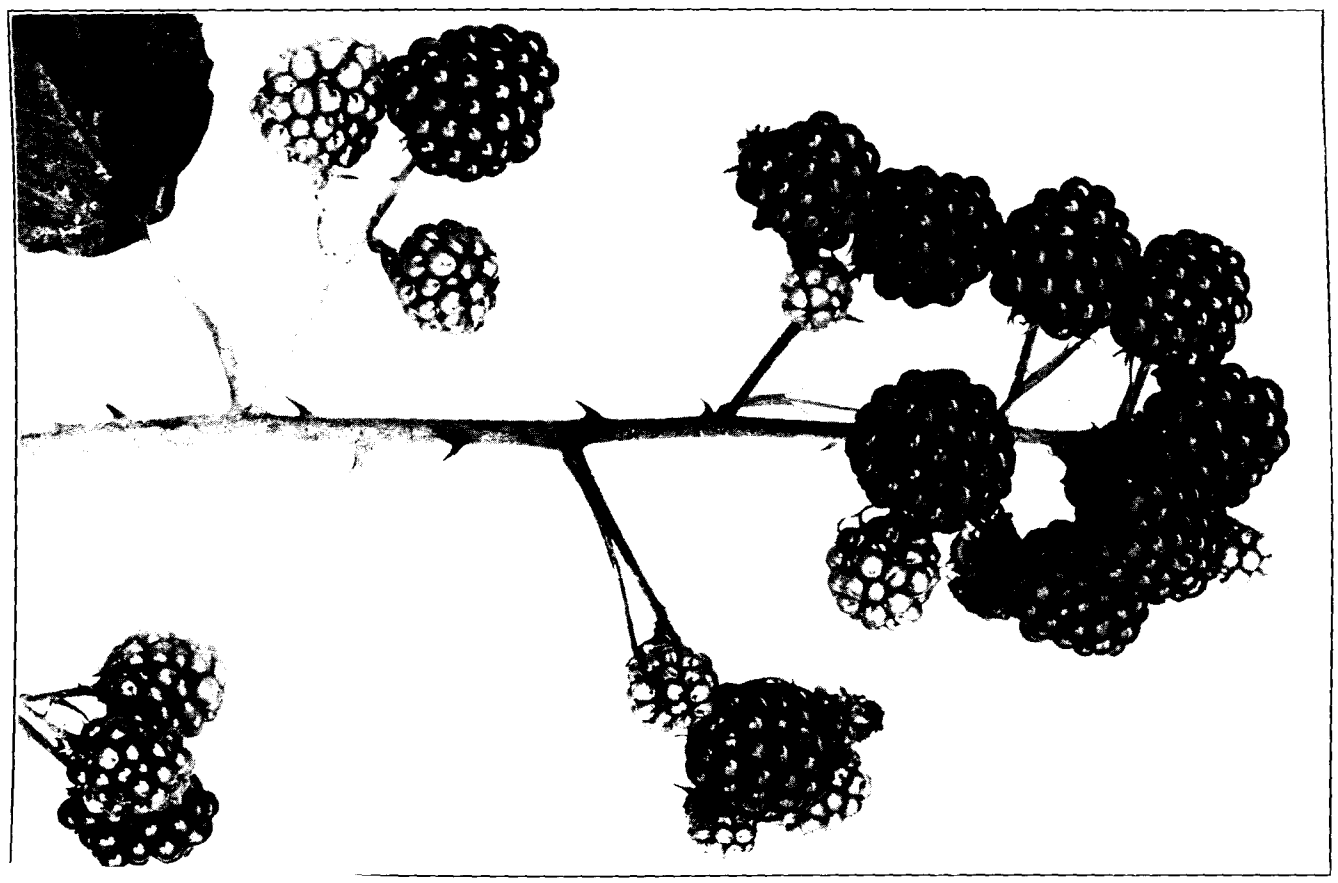


FIG. 5. Seedling Blackberry, RT4.

FIG. 6. Spineless Seedling Blackberry out of RT1 selfed.

cell will contain the normal single set of 17 chromosomes, but the pollen cells will contain some irregular number obtained by the division of 3 sets of 17. So irregular is this division that only 30 per cent. of the resulting pollen grains are stable enough to grow, and, as we have seen, even the good pollen only succeeds in a few cases in making a viable seed.

A cell cannot survive and multiply unless there is a certain symmetry and balance among its chromosomes. For example, seedlings that are derived from two individuals of the same species are healthy and fertile. Each plant has contributed an identical set of chromosomes and the total complement consists of perfectly balanced pairs, represented as above by AA BB CC DD, etc. Crosses between varieties that differ but little, so that they may be represented by AA Bb CC DD, etc., are equally fertile. But many crosses between species which differ so much that they would have to be represented as Aa Bb Cc Dd, etc., fail to yield viable seeds, or if viable their seeds may in turn be sterile.

This sterility of the hybrid is often taken as a proof of the specific difference of the parents. The typical example is the sterile mule. The non-viability or sterility of the seed is due to the fact that the balance of the nucleus has been upset by the too great or too numerous differences existing between the homologous chromosomes contributed by each parent. It is only to be expected, then, that the irregular make-up which must result from the union of the single set from the diploid with the imperfectly halved set of the triploid will be such an unbalanced structure as to survive with difficulty, if at all. Thus we cannot expect to get seedlings of any value if we use triploids either as seed or pollen parents. It is on record, indeed, that apple breeders have failed when starting with Bramley's Seedling and Gravenstein, an American variety which now proves to be a triploid.

These conclusions regarding the triploid apples are greatly strengthened by the parallel but more extensive cases of polyploidy occurring among the cultivated Rubi. Here again we start with diploids—the common Raspberries and Blackberries, and we can get fertile hybrids between them. But some of the wild blackberries are tetraploids, among the most notable being the so-called Himalaya Berry, now being extensively cultivated. (There is no justification for the name, for it is a tetraploid of a species widely distributed in Central Europe.) The well-known Loganberry, of somewhat uncertain origin, is a hexaploid, again with an even number of

sets of chromosomes. By hybridization among these various complements, plants with odd numbers of sets of chromosomes have arisen, *e.g.*, the "Mahdi" which is a triploid and the "Laxton Berry" which is a heptaploid. Now since the production of fruit in the Rubi involves the formation of a fertilized seed in each drupel of the compound fruit, it is easy to understand why all the hybrids with an odd number of sets—the triploids, pentaploids and heptaploids, are very much less fruitful than the diploids, tetraploids and hexaploids.

The plant breeder must thus avoid all matings that would give rise to an odd number of chromosome sets in his seedlings. Often, again, a tetraploid turns out to be more fertile than the diploid from which it proceeded; even a sterile hybrid may recover fertility if converted into a tetraploid. Among the first of the tetraploids to be discovered was that arising from *Primula kewensis*. That plant was a hybrid raised at Kew from two distinct species, *P. verticillata* and *P. floribunda*, and was perfectly sterile. But after some years one shoot was noticed to be bearing seed, and this seed turned out to be thoroughly fertile, so that it became the starting point of thousands of plants which are raised from seed every year. Now this fertile strain consists wholly of tetraploids. The original fertile shoot had arisen from a doubled cell and with the doubling of the number of chromosomes fertility had been restored. We can surmise that while in the hybrid diploid the dissimilarity between the chromosomes contributed by male and female may upset the balance, yet with a double number of such chromosomes a stable structure can be built up.

This restoration of fertility following upon doubling to a tetraploid is a matter of real economic importance, for though we cannot, except in a few cases, make tetraploids at will, we can arrange favourable conditions and be on the look-out for their casual production. An instructive example is afforded by the hybrid blackberry RT4 raised by Mr. M. B. Crane at the John Innes Institution. There exists a variety of one of the commonest blackberries, *Rubus rusticanus inermis*, a diploid with 14 chromosomes which possesses one good quality in that it is devoid of spines and prickles. Otherwise it is worthless, being practically useless for fruit production. In the course of numerous trials Mr. Crane did succeed in obtaining four good seeds by crossing it upon *Rubus thyrsiger*, another wild blackberry which, however, is a tetraploid with 28 chromosomes. Three of these seeds produced, as would be expected, triploid plants of no value, but in the fourth case a

very exceptional union had taken place resulting in a tetraploid. Presumably an unreduced nucleus of *rusticanus* with its full complement of 14 chromosomes had united with the normal reproductive half-nucleus of *thyrsiger* also with 14 chromosomes. The resulting tetraploid RT4 thus contains 28 chromosomes, being one complement of *thyrsiger* and two of *rusticanus*. With this doubling, the sterility normally found in such crosses disappeared. The new hybrid is exceptionally fertile and vigorous, indeed, in productiveness, size and flavour it is one of the finest blackberries known. RT4 is fully prickled (Fig. 5), because the spineless character is recessive, but being a hybrid it is still carrying the spineless character. A family of about 500 plants was raised from its self-fertilized seeds and among these 20 reproduced the completely spineless character of the original *rusticanus* parent (Fig. 6). Actually none of the spineless seedlings possesses the cropping power or quality of their RT4 parent, but seedlings are being raised from them, and it is only a question of time and perseverance before a variety will be produced combining spinelessness with the other qualities desired in a blackberry for general cultivation. By the fortunate accident of getting a tetraploid the sterility that was associated with the spineless character has been removed, and this fertility will persist in the new race.

The Special Case of the Apple.—With these examples in mind of the restoration of sterility in an unbalanced nucleus when the number of chromosomes is doubled we can return to the consideration of a point that had been left unexplained when discussing apple breeding. Blenheim Orange, Bramley's Seedling and others are triploids which cannot properly go through the division preparatory to sexual union, and this explains why they set few seeds, and those of little vigour. But if it only needs a little lack of balance among the chromosomes in the nucleus to render the cell inviable or sterile, how can these derivatives or triploids manage to live at all? The sorting into two portions of the three sets of 17 chromosomes which the triploid nucleus contains not only cannot be done but must introduce into the new nucleus an exceptional number of chromosomes that is not a multiple of 17. If the division and the subsequent reassembling are at random, the odds against the occurrence of a complement like either the diploid or the triploid are extravagantly great, and all other arrangements ought to be too unbalanced to live. Yet,

as we have seen, some seedlings from triploid apples do grow, even if in a weakly fashion; indeed, if we are to trust the old tradition, Cox's Orange Pippin is a seedling from the triploid Ribston Pippin.

The clue to this behaviour has recently been provided by the research of Dr. C. D. Darlington and Mr. A. A. Moffett at the John Innes Institution. They have demonstrated that the apple with its two sets of 17 chromosomes is already an irregular or derived polyploid. The apples and other Pomoideae with the basic chromosome number of 17 are themselves members of the great natural order of the Rosaceae in which a basic chromosome number of 7 is common. The 17-set of the apple is this 7-set of the Rosaceae order repeated twice in full and a third in part, so that the nucleus of the diploid apple may be represented diagrammatically as

AAA	AAA
BBB	BBB
CCC	CCC
DD	DD
EE	EE
FF	FF
GG	GG

and of the triploid apple as

AAA	AAA	AAA
BBB	BBB	BBB
CCC	CCC	CCC
DD	DD	DD
EE	EE	EE
FF	FF	FF
GG	GG	GG

Now obviously a stable structure is much more likely to be obtained from the division of such a group, in which there are only 7 different chromosomes each repeated 6 or 9 times, than of a group of 51 chromosomes in which there are 17 different ones each repeated 3 times. Indeed, we cannot regard as impossible the formation of a diploid group, as in the presumed origin of the diploid Cox's Orange from the triploid Ribston. Cox's Orange is an exceptional apple as evidenced by its self-sterility, and in all probability owes its peculiarities to some irregularity in its chromosome outfit due to its abnormal origin from a triploid.

The complex polyploidy of even the diploid apple that has thus been revealed serves to explain some of the difficulties that had been experienced by apple breeders. The characters

of the apple seemed only approximately to obey the ordinary Mendelian rules of inheritance. For example, when plants with coloured and colourless flowers are crossed the hybrid offspring are generally coloured, and their descendants when intercrossed reproduce the colourless forms in the proportion of one in four. But when green and red apples are crossed all shades are found in the progeny, some even more coloured than the red parent. Since, however, the chromosomes of the apple are

AAA	AAA
BBB	BBB
CCC	CCC
DD	DD
EE	EE
FF	FF
GG	GG

then if the chromosome A carries the colour factor and can be replaced in other varieties by its opposite number (a) without colour, the hybrid apple may have six grades of colour ranging from AAAAAA (full red) to aaaaaa (full green). Inheritance thus becomes a very complex affair, almost impossible to disentangle except by raising impossibly large families. None the less the new knowledge will be helpful to the apple breeder, even if it only prevents him from rejecting some of his results as amenable to no explanation.

Meantime this discovery that the Pomoideae are irregular polyploids derived from the main stock of the order Rosaceae is of great scientific interest because it indicates how the evolution not only of new species but even of new genera may proceed. How or when the exceptional nucleus with 17×2 chromosomes was built up from 7 basis we can never know, but we recognize that amongst the countless millions of cell-divisions some abnormal grouping happens from time to time. As a rule they perish, but once in a way a stable combination occurs and then a new species, even the starting point of a new genus, is born *per saltum*, by no gradual process of adaptation.

In this particular case we can surmise that the process began by sexual union between a diploid and a triploid of the Rose order. The diploid would contribute the normal 7 chromosomes, the triploid 10 as approximately half of its total of 21, thus producing a hybrid with a total of 17 chromosomes. This presumably sterile hybrid then had to double itself to create the original progenitor of the apple family. However, it is

extremely unlikely we shall ever be able to do more than guess at the order of events which led to the multiplication of the 7 chromosomes of the primitive Rosaceae into the 17 of the Pomoideae family.

One moral the scientific man may be permitted to draw from this story, and that is the dependence of practical economic investigation upon pure abstract research, seeking knowledge for its own sake. The study of the cell nucleus has been pursued for many years by scientific men in all countries without the least idea that it would have any bearing upon practice. It took a long time to arrive at a clear picture of the complex processes involved in cell-division and sexual union, but then it was discerned that the scheme corresponded to and explained the conclusions about inheritance that were being worked out by another unrelated set of investigators. Finally, from these separate sources emerges the fundamental theory which now guides the work of the breeder of apples.

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FURTHER EXPERIENCES OF GRASSLAND MANURING

G. T. GARRATT.

IN the March, 1929, issue of this JOURNAL was given an account of an experiment in grassland manuring that I had undertaken in the previous year. It may, perhaps, be of interest to describe a further year's working of the system there described. The farm is on Boulder Clay, in Cambridgeshire, the typical "wheat and bean land" which is nowadays very difficult to keep profitably under the plough, and as a consequence this land is being rapidly laid down to what is often rather poor grass. In 1928, the method of nitrogenous dressings and rotational grazing had been tried on five plots of about 4½ acres each, but in 1929 a sixth plot was added, partly because five plots had been shown to be insufficient, even in a normal year, and partly to try the effect of nitrate of soda. All the plots except Nos. 3 and 4 received a dressing of 4 cwt. of basic slag, which was applied early in December, 1928. Plots 3 and 4 had been rather better treated prior to the introduction of the intensive method, and they were also older grass land, having been laid down shortly before the War, while the other land was laid down between 1919 and 1921.

The early nitrogenous dressings were as follow:—

Plot 1.—1½ cwt. per acre of calcium cyanamide were applied on November 1, 1928, and a similar dressing at the end of January, 1929. A dressing of ¾ cwt. per acre was given after the first grazing on April 16.

Plot 2.—1½ cwt. per acre of sulphate of ammonia were applied at the beginning of February, and an equal dressing at the end of March, after a short grazing.

Plot 3.—Only one application of nitrate of lime was given. This was on March 19, 1929, before any grazing had commenced.

Plot 4.—1½ cwt. per acre of calcium cyanamide were drilled on November 1, 1928, and a subsequent dressing of 1¼ cwt. nitrate of soda was given on April 18, 1929, after the plot had been grazed.

Plot 5.—1¼ cwt. per acre of nitro-chalk were applied early in March, and a second equal dressing in May.

Plot 6.—1¼ cwt. per acre of nitrate of soda at the beginning of March, and the second dressing after grazing in April.

A smaller herd was run on the plots than in the previous year, there being only 11 cows in milk, and 13 "stores," all heifers. Three autumn calves joined them later. The usual rotational method was adopted. The cows had the first grazing of each plot, and were followed by the store cattle. As soon as the latter had got the grass quite short they followed the cows on the next plot, and the original plot was well harrowed, and would sometimes be given another dressing. In 1928, it was found that when grass was scarce, as during a dry July, the movement round the plots was too quick for them to have time to recover. It was hoped that this defect would be obviated by adding a sixth plot on which a quick-acting manure would be used.

It was suggested in the previous article that the weather was "an all-important factor" in the dry Eastern Counties; 1928, however, was a comparatively normal year. The year 1929 was abnormal and, even with an extra plot, the rotational system would not work according to plan. The cost of the nitrogenous manuring of grass land has to be recovered by getting (1) at least a fortnight's earlier grazing in the spring, (2) more "keep" than usual at the end of the summer, and (3) better quality grass from the beginning of July onwards.

In 1928, most of these expectations were realized, though two periods of drought made it difficult to dress the fields regularly after July, and the system had to be abandoned in August. There was, however, useful grazing by March 20, which was a fortnight earlier than on neighbouring farms, and there was extra grazing for about three weeks in the autumn. The remarkably fine condition of the stores in October was evidence of the quality of the grass.

In 1929, the weather upset plans from the first. February and March were exceptionally cold, and the ground was

frost-bound until the middle of March. The cows were actually let out on to Plot 2 by March 23, but they found little to eat, and the other plots were so backward that it was useless to start a rotational system. The only field with any real "keep" for the first three weeks was one outside the experiment, which had been dressed with farm-yard manure during February, and was intended for hay. After a few days on each plot, and a week on the hay field, the cows started again on Plot 2 about April 24.

What should have been the second round of grazing was now upset by the grass growing too fast. A fortnight's warm wet weather produced a very rapid growth, and ultimately it was found necessary to shut off Plots 1 and 3, and cut them for hay. They were both closed in May, and mowed on July 4, when they yielded a light crop of just under 1 ton per acre. Between June 4 and October there was only one shower of rain, and this made a double difficulty. By the end of July, all the plots were either mown or eaten short, and the ground was so hard and dry that it seemed useless to continue the nitrogenous dressings. The water supply in some of the plots also became precarious, for it was dependent upon ponds, and these ran dry for the first time in the memory of anyone working on the farm. It became impossible, therefore, to continue either the dressings or the rotational system, and the cows had to be allowed a free range. They certainly managed to keep up their condition and milk yield from grass which seemed to be cropped right down to the ground, but it was impossible to attempt any quantitative estimate of the feeding value of the different plots. Probably, only in very favourable years would any exact comparison be possible, and the writer can give only the following rough impressions from the two years' working.

Conclusions.—(1) In the drier counties it is not practicable to work on any definite system throughout the summer. After May, it is probably unwise to rely on rainfall or ground moisture sufficient to justify periodical dressings of nitrates. It is, however, useful to keep cows and stores moving round the plots, harrowing vigorously after the latter have left.

(2) After a very cold winter, a field dressed with fairly "long" farm-yard manure, even as late as February, will give an earlier "bite" than any artificial manure, presumably because of the mulching effect of the straw.

(3) Cyanamide, even when applied in November, cannot

be relied upon to give an early result in the spring. Dressings, as described above, on Plots 1 and 4 had a very marked effect as soon as the weather got warm, but to get results "up to time" a quicker-acting nitrate is needed. It should, however, be pointed out that on both plots the two years' treatment has had a very beneficial effect on the herbage.

(4) Sulphate of ammonia seems to give the quickest growth, with nitrate of soda a very close second. The nitro-chalk plot appeared to be very palatable.

(5) It is probably uneconomical to apply quick-acting manures in the spring to more than two plots. This should give the fortnight's extra grazing, which is as much as can be expected in the Eastern Counties. On heavy soils it is likely that the soft state of the land will make it undesirable to turn out cows too early. The alternative method, of treating all the plots and, if necessary, cutting one or two for hay, does not seem very satisfactory.

(6) If a farmer intends to use the intensive method in order to run a considerably larger head of stock than usual, it would certainly seem advisable to grow some arable crop which can either be turned into hay or fed green.

(7) It is probably best not to run too many cows on the plots, but to keep the store cattle as the variable factor, regulating the number which follow the cows so as to be able to clean up well after the cows have moved on. The plots, even in 1929, provided enough grass to keep the cows well up in their yield. The cows received no cake until the end of September in either year, but the year's average for a non-pedigree Shorthorn herd was 880 gallons the first year and over 830 the second. The store cattle also kept their condition very well.

(8) After June, it is best to take advantage of any wet spell to apply some quick-acting manures, instead of working on the proper rotation and relying on periodical showers.

(9) If any portion of a plot is inclined to grow rank it is worth while running a mower over that part. If the rotational system is working well, both cows and stores get rather fastidious. It was found that certain parts of the plots were left, but once cut the cattle would begin feeding evenly again.

(10) The writer feels that if the system is to be economically sound the nitrogenous dressings must never be used to push on the natural spring growth, but only to make an artificial growth for a short time before, and for a longer period after, the normal spring flush of grass.

THE IMPROVEMENT OF FARM LABOUR AND ITS MANAGEMENT BY EDUCATION

W. R. DUNLOP.

1.—Introduction.—For several years past the writer has carried out investigations in connexion with the efficiency and welfare of farm labour, in the expectation that it might be possible to effect readjustments and improvements on farms, to the benefit of both worker and employer, as has been done with notable success in industry and commerce. For example, it was considered likely that by closely analysing the work of each man on any farm it might be possible to show him how to save time and energy; by studying tools and appliances and the lay-out of fields and the interior of buildings to effect labour-saving adjustments; by studying the question of incentive and farm "relations" to introduce new systems of payment, etc., and by means of scientific selection to aid the farmer in securing men particularly suited for certain jobs or conditions. While investigations along these lines in different parts of the country have shown that there are possibilities,* it has been found that on account of the inherent nature of agricultural activity and conditions, improvements can only be introduced *gradually* and at the right time, and then only (except in highly technical matters) by the farmer and the worker making such improvements for themselves. Even then it is not by isolated and necessarily tangible adjustments that labour and its management is to be improved. It is more a question of keeping the efficiency idea steadily in mind and letting it consciously, and even unconsciously, influence every action and thought during the year's work.

Thus, the writer has come to take the view that it is *education* that is needed; that the thing to concentrate on is the individual rather than the work, and to try and create in both farmer and worker the right attitude of mind towards both labour efficiency and other equally important aspects of scientific management. This, in the writer's opinion, cannot be achieved merely by the experimental demonstration of

* Report on An Investigation of Certain Processes and Conditions on Farms: W. R. Dunlop (National Institute of Industrial Psychology, London, 1927).

Report of Efficiency Investigations in Connexion with Farming: W. R. Dunlop (Ministry of Agriculture, 1928).

Industrial Psychology and Agriculture: W .R. Dunlop. (See *Industrial Psychology*, Home University Library, 1929.)

Report on Efficiency of Sugar-beet Lifting: W. R. Dunlop (Investigation carried out for the late Hon. E. G. Strutt, not published).

improved adjustments, even under commercial conditions. Very often there can be nothing *visible* to demonstrate. In any case, adjustments that may be good for one farm may be quite unsuited to another. It is mental training in principles and ideas that is needed, though of course research and investigation are absolutely essential in order to secure the necessary facts and methods of procedure, and for testing new educational notions.

The purpose of this article is to suggest what this education for the improvement of farm labour and its management should be; to enumerate the main topics and ideas in which instruction should be given; and to illustrate these by means of examples drawn from research in the field. Before proceeding with this task, however, four important facts must be noted.

(1) First, it must be emphasized that any attempt to educate the worker, which in the present instance is the primary aim, must be accompanied by a similar and simultaneous effort in regard to the farmer. One without the other, from a practical point of view, is useless. All that is put forward in this article is, indeed, intended as much for the education of the prospective farmer as the prospective worker.

(2) The second point is that educability sets a limit to the effectiveness of education. There must be capacity and willingness to learn as well as opportunity to learn. The kind of education in view, however, is of such a character that only those who are actually mentally or temperamentally defective can fail to benefit to some extent; while anything in the nature of "over-education" is strictly guarded against.

(3) The third point is that the existing and relatively low level of wages and limited scope of advancement in agricultural work does not render any attempt at the better education of the worker futile. Actually the kind of education in view is *one* of the only things that can better matters in this respect. In any case, there must always be agricultural workers for society to exist at all, and an attempt to train and educate them scientifically is obviously desirable and to the public good.

(4) The fourth and final point to be noted is that education, like farming itself, is a very slow business and takes time.

2.—Education before Employment.—The study of labour on farms has shown that, quite apart from mental capacity, the attitude of mind is usually entirely unsatisfactory for educational work. Something, no doubt, can be done with

the younger men, and attempts are being made by the writer to test possibilities in this direction; but the most hopeful and scientific procedure is to begin with the child at school.

The first essential is vocational guidance in the rural, and possibly in the urban, elementary schools. In order to find out which boys (and girls) are best suited for agricultural (including horticultural) pursuits, it is first desirable to know exactly what qualities of mind, character and physique different agricultural pursuits call for. To secure this information jobs must be analysed: that is to say, work and working conditions must be closely investigated and the muscular, sensory, mental and temperamental qualities needed carefully enumerated and checked by one or more persons familiar with the work and capable of giving a truthful and unbiassed opinion. Agriculture really consists of about 12 entirely different kinds of occupation, ranging from corn growing to poultry farming, and from glass-house work to sheep farming. All require certain common qualities, but each one also calls for certain special qualities—to a much greater extent than is usually realized. It is not so much a question of skill as of suitability. The amount of "skilfulness" required in farm work is often greatly exaggerated.

To pursue the idea of vocational guidance, the next procedure is to select those children who appear to be well suited for agriculture and special branches of agriculture, and to test their response to the vision and intelligent explanation of different jobs in progress under actual economic conditions. An attempt is being made to do this by means of carefully planned "farm classes" on farms where the work is carried out efficiently under decent conditions. The object is *not* to try and entice the child into agriculture, nor to teach the child an agricultural job. The object is merely to introduce the child to and familiarize him with the worker and his work (under decent conditions), in order to see if this arouses any interest and desire. The object is certainly to create an impression of the value and interest of agricultural work and to show that it is not to be despised, but otherwise it is entirely a matter of studying responses to stimuli.

It will be realized that work along these lines is essentially different from school gardening, etc.—work which is useful, but of limited value from an educational point of view.

3.—Education during Employment.—The foregoing plan refers to children of 11 to 14 years, or possibly younger. It presents few practical difficulties owing to the existence of

control. It is educational effort between 14 and, say, 18 that presents the greatest difficulties, and yet this is the period, and probably in most cases the only period, during which there is any hope of educating and training the worker. More serious still, it is the period during which, without continuation classes, the effects of even good elementary education are largely lost owing to the irresistible competition of money, sex, sport, dress and other "interests," including the "pictures." In Germany continuation classes are compulsory: in England, and with special reference to agriculture, everything depends at present on securing some measure of constructive co-operation between parents, the educational authorities and the farmers. Farm institute training, even if it were in every way suitable, is not, and probably never will be, available to the masses. The education and training of the average farm worker must be carried out somehow on the farm. We now see one of the reasons why it is so important for the farmer himself to be well educated. As well as being a farmer, he is asked to be a bit of a schoolmaster.

Reverting to the fundamental notion of vocational guidance, the ideal would be for the elementary school to recommend a suitable boy to a suitable farmer, and if a job were offered and accepted there would be an understanding, in writing, between the parent and the farmer in regard to wages, continuity of employment, education and prospects—not legally but morally binding, and, of course, in every way reasonable to both parties.

It is, of course, unnecessary, and indeed undesirable, that the farmer should be totally responsible for the education and training. Continuation classes for instruction in certain topics could be arranged at the nearest village school, and possibly more might be done in certain cases by means of correspondence classes and visiting instructors; but the farmer would have to help and insist on regular attendance.

From the economic point of view one great difficulty in the way of any such arrangement would be the question not so much of immediate wages as of prospects. This matter will be dealt with later. It may be mentioned here, however, that it is very important to know how long it should take to train a general or specialized agricultural worker, and more important still, at what age he can be regarded as sufficiently responsible to be relied upon. It is this *reliability* which is so important in agricultural work. Unless the time limits which most farmers regard as necessary can be greatly reduced

the chances of improving labour by education or anything else are very much minimized. No intelligent and energetic boy can be expected to wait willingly until the age of 30 to become a shepherd or a cowman with only 42s. per week. As will be emphasized later, prospects on the farm could be greatly increased by pensioning the aged workers, who at present are far too numerous. There is the further question, also, as to whether change of position may not be desirable for purposes of gaining wider experience. Here one must distinguish between change of job and change of occupation. The former may be desirable; the latter is not desirable, but by no means infrequent in connexion with agricultural work. We need to know a great deal more about the causes and circumstances of these changes.

For the present, however, we are concerned with education itself on, or associated with, the farm. The important thing to decide is what the nature of this education and training should be. At the outset it must be recognized that the average boy who takes up farm work under existing economic conditions will nearly always have a rather low standard of general intelligence, probably not above the normal for 11 or 12 years. The instruction would, therefore, have to be simple and very elementary, though this would not detract from its having a very important educational influence. What we are after is not so much to impart knowledge as to create the *right attitude of mind.*

In order to afford some idea as to what the writer considers the education and training should be, we may take, as an example, a boy who is intended for a cowman, and starts as a milker on a good Grade A herd. Obviously his first task will be to learn to milk. There are good and indifferent ways of milking and of learning milking, and this should receive close attention. Coming now to what is more strictly educational, the boy might be shown, during his first year, how time can be saved by avoiding unnecessary movements, and in having the right thing in the right place; the meaning of being methodical and thorough; something about different breeds, foodstuffs, feeding and appliances; sterilization and cleanliness; and the importance of kindness to animals. In his second year elementary facts of parturition in the cow might be given, and symptoms of disease and particularly ailments; elementary facts concerning lighting and ventilation in relation to cowsheds; herd management in different districts and different countries. During the third year the most

important of all educational effort would be made, namely, to explain the economics of wages—how wages depend on costs, revenue and yield; the advantages of piece work; and the relations that should exist between farmer and worker. Above all, an attempt should be made to develop keenness and "open-mindedness" in regard to new methods and ideas, and an appreciation of just and constructive criticism.

The foregoing indicates in a very general way the kind of instruction that might be given to the young specialized worker. More often than not, the young worker would be engaged for general work on a farm. In this case the instruction—particularly the technical instruction—would also be general, *i.e.*, less specialized. More attention would be given to implements and machinery and their care and adjustment, the cultural requirements of different crops, and so on. The most important instruction, however, would be that which has regard to efficiency and economy of labour, and the relations that should exist between farmer and worker. It is important to note that in the case of the general worker vocational guidance is not completed. The *occupation* has been chosen (*i.e.*, agriculture), but not the *job*. It is necessary that the vocational guidance authority should keep in touch with the young general worker. It is true that he may not wish to specialize, or may not possess the requisite natural qualifications: but specialization is to be encouraged if possible on grounds of increased earnings and efficiency.

In addition to all this it is desirable that the young worker should be made thoroughly familiar with all possibilities of advancement in agriculture: small holdings, emigration, supervision (foreman's work) and even managerial work. The ability, risk and responsibility which these involve, however, should be explained.

4.—The Efficient Utilization of Labour.—The greatest education (and satisfaction) which the worker can have is to see and realize that his labour is being efficiently and considerately utilized by his employer, to their mutual advantage. In order that labour may be utilized with the utmost efficiency in farming it is necessary to give definite and constant attention to a number of important points and principles. It is highly important that a young man who is going to be a farmer or farm manager should receive instruction in these principles. We have already prescribed the germ—which is efficiency with fairness—in the instruction of the

worker. We now have to develop this more fully and in greater detail for the information of the prospective employer.*

(1) *Knowledge of the Social Sciences.*—To provide the necessary intellectual background for efficient administration in regard to the more practical matters which follow, it is desirable that the prospective manager of farm labour should acquire some knowledge of the elementary principles of ethics, economics and industrial psychology, and some knowledge of industrial history and geography.† Any reasonably educated person can obtain a satisfactory introduction to these subjects by the careful reading of one or two small popular works such as *Supply and Demand*, by H. D. Henderson, and *Industrial Psychology*, edited by Dr. C. Myers.

(2) *Seasonal or General Unproductive Time.*—One of the biggest problems in most branches of farming is to find a way of reducing unproductive time, or time not altogether economically utilized, caused by bad weather, "waiting for things to grow," etc. This form of waste can only be overcome :—

(*a*) by carrying a smaller number of permanent hands and employing seasonal labour (nowadays often very difficult and unsatisfactory) ; or

(*b*) by carrying a full staff (adequate for the busiest periods) and devising profitable (*i.e.*, revenue-yielding) work during the slack periods. This also presents difficulties.

It will be sufficient to mention here that the problem is being investigated, and that it is hoped, in connexion with (*a*), to effect improvements at the Labour Exchanges, and in connexion with (*b*) to try the experiment of a farm "industrial section." Educationally, it is most important that labour should realize that seasonal unproductive time, especially in arable farming, is a serious problem affecting wages and profits alike.

(3) *Job Unproductive Time.*—This form of unproductive time is that proportion of the total time of actual operations in the field or buildings which may be said to be wasted. Necessary rest to eliminate or prevent fatigue (either physical or mental) is *not* unproductive time. Unproductive time can be lessened or tend to be lessened by giving attention to (*a*) the improvement of lay-out, (*b*) the prevention of unnecessary stoppages and delays and (*c*) good routing and transport.

* The majority of points (those marked †) should also be instilled into the mind of the worker. Many of these are to be regarded as included in the instruction of the worker (*see* Sec. 3).

† An exact acquaintance with agricultural conditions abroad is most important.

(*a*) Occasionally the shape of a field can be economically improved or two small fields thrown into one. Experiments in this country and in Germany have shown a considerable saving (by reducing turning, etc.). The position of gates can sometimes be economically altered. Improvement of the internal lay-out of buildings is also possible, *e.g.*, in horticultural and egg-packing sheds, cowsheds, milk-rooms, etc.

(*b*) †Low earnings amongst women topping sugar-beet on piece work (and consequently slow clearance of the crop) have been shown by the writer to be due to excessive talking. In potato hoeing by a gang of men on day work 15 per cent. unproductive time was measured, after allowing 15 per cent. for resting. This was due to stoppages caused or accompanied by talking.

Breakdown of implements and machinery is well known to be a common and often very serious cause of delay. It has been observed by the writer in regard to the self-binder, thrashing machine, grass-mower, hay-tedder, potato-digger, sheep-shearing machine, and, of course, tractors. In some cases it has been due to definitely faulty manufacture, but usually to lack of systematic overhauling.

Planning ahead includes letting the workers know in advance what their next job is to be, or likely to be ; calculation and arrangement for what is needed, *e.g.*, adequate number of receptacles such as sacks in potato harvesting.

†Organization and "flow" are important points. In haymaking, for example, where there is both a carrying and a stacking gang, the rate of work should be well balanced. In the harvesting of potatoes the pickers must be able to keep pace with the tractor, and *vice versa*. One or more indifferent workers in team work may and often do upset the whole operations.

Delays and stoppages can sometimes be prevented by intelligent anticipation of change in weather. Apart from making his own observations, the farmer should carefully study each morning the official weather map (published in *The Times*). As an illustration it may be said that on a certain farm, during definitely unsettled weather, one morning was fine. Rain was expected, and arrived in the afternoon. Two jobs had to be done : some cattle "drawn" for market in the pasture, and wool packed in the barn. The wool was packed in the morning when the weather was fine, and the cattle "drawn" in the afternoon in the rain, heavy enough to interfere with the work : by no means a satisfactory arrangement.

(*c*) †Delay in getting from one job to another is often a cause of much time being unproductive. The only remedy lies in education and incentive.

It is important for several reasons that farm workers, particularly those in charge of live stock, should live close to their work. In one instance (in Oxfordshire) a waggoner was found to be living three miles away from his work. On the other hand, there are social advantages in living in or near a village, *e.g.*, getting the children to school. Generally, however, it is desirable for cottages to be within easy distance of the farm.

†Shepherds, stockmen, poultrymen, etc., do not always take the shortest routes in the execution of their duties.

This has been observed by the writer in relation to egg collecting and pig feeding.

†As much as possible should be done on a single journey. Poultrymen have been observed to waste unnecessary time and energy through not combining two operations on one journey. A shepherd on his round may forget to take something for which he will have to return.

†Defective methods and arrangement may often be observed in connexion with the carting of sugar-beet and potatoes. The unproductive time of one of three men loading sugar-beet was found to be 50 per cent. through the rows of heaps being so close together that one row had to be straddled. The quickest method of shifting potatoes (main crop) is the Isle of Ely method, in which the carter throws 30-lb. basketfulls to a lad in the cart while it is in motion. Wheelbarrows have been observed in use for food transport on poultry farms when a small two-wheeled cart would have been more economical.

† For communication in the field it is certain that semaphoring would save time and energy on many occasions. It would do the farm worker good educationally to be taught to semaphore. Normally, however, it is desirable that the farmer should give his orders orally.

(4) *Productivity of Productive Time.*—†Productivity of productive time really refers to *rate of work* in respect of some centrally productive process. For instance, the rate at which a man actually milks a cow or shears a sheep or pulls up sugar-beet. It is a fundamental principle that *quality of work and reasonable comfort must never be sacrificed in endeavouring to obtain a faster rate.*

(*a*) The young novice must be given adequate instruction as to how to do a certain job from the very start (*see* Section 3). Nervousness must be dealt with sympathetically.

(*b*) † There should be regulation and wise application of energy. A steady pace is required, not dashing work. Most jobs have a rhythm and this should be "caught." Rest pauses should be taken, if possible, during enforced unproductive time, *e.g.*, at the headlands, in cultivation work. Wherever possible the worker should ride rather than walk. In ploughing the worker should not lift the plough in turning more than is necessary: the horses can pull it round. When two or more men are on a single job involving different processes they should periodically change over.

(*c*) † Waste movements should be eliminated, and correct movements insisted on. This is extremely important in fruit and hop picking.

(*d*) † Defective tools and appliances are often responsible for a reduction in the productivity of productive time. They not only have an undesirable physical effect but may cause mental irritation, especially if the worker is on piece-work. Instances have been observed of defective dipping tanks for sheep, shearing machines, scrapers for cleaning out poultry manure, bags and receptacles, knives for chopping sugar-beet, etc.

(*e*) † Much can often be done to make work easier and therefore to increase the rate (or make an increase possible) by devising or adopting mechanical aids and substitutes. The employment of a "couch" in the trimming of sheep is a typical example; also the use of a mirror on a tractor to save the driver from continually turning round.

(*f*) † Bad adjustment of machinery and implements is often a serious cause of slow and inefficient work. Instances observed include badly set sugar beet lifter, bad adjustment (only requiring new washers) of a double Cambridge roller, and handles much too high in a disc horse hoe.

(*g*) † The provision of the *optimum* lighting and ventilation in cowsheds, stables, food-mixing sheds, brooder houses, etc., is highly important, not only for the workers but for livestock. In spite of official regulations and expert opinion, very little is known as to what exactly is desirable. Photometer and Kata-thermometer measurements made by the writer have yielded interesting results, not only in buildings but also in the field. As regards clothes, there is no doubt that the worker's garments and footwear are not always as suitable as they might be.

(*h*) † Although taken last, incentive is by far the most vital factor affecting rate of work. It brings us back to the old question of wages, the importance of which has been fully realized throughout this article. The essential thing for the prospective farmer to grip is the importance and possibilities of piece-work payment and of bonuses. Even with labour what it is, the majority work better where piece-work and/or bonuses can be arranged. When the educational standard of the farm worker has been raised it is likely that piece-work and bonuses will become general. Much remains to be done in devising more scientific methods of fixing rates of payment. Money, however, is not the only incentive on the farm. Prospects, pride of work, interest in work and loyalty to the employer can and should be important motives. This brings us to the final and highly important question of relations between farmer and worker.

5.—Relations between Farmer and Worker.—Many writers on social and economic questions (who are sometimes unacquainted with practical realities) would be tempted to discuss this question at considerable length. Not only in the present instance is such a course prohibited by lack of space, but it is actually unnecessary. All we need to do is to enumerate those points concerning which we should like to see a more explicit understanding as between farmer and worker on every farm. The main points are that:—

(*a*) Labour has the right to expect the farmer to farm efficiently.
(*b*) The farmer should settle grievances and disputes judicially and scientifically.
(*c*) He should aid the advancement and education of his workers.
(*d*) He should give the best possible attention to the question of housing and to making work and conditions easier.
(*e*) He should encourage suggestions.

On the other hand, labour must

(*a*) "Pull its weight" and obey orders willingly.
(*b*) Work conscientiously and well.
(*c*) Be responsive to new methods and ideas.

(*d*) Realize the farmer's difficulties and responsibilities, and that wages are a first and very serious charge on revenue.
(*e*) Understand that "minimum wage" is not intended to mean the "minimum amount of work," and
(*f*) That higher wages can only (and in future will always) accompany more profitable farming.

There is one final point to be considered: the effect of an "efficiency policy" on unemployment. There is first the case of the aged worker who is incapable of strenuous work. Many such men are retained on farms partly for humanitarian reasons and partly because younger men are often less reliable and generally less experienced. It seems legitimate to hold, and to teach, that it is unsatisfactory that this should be necessary. In general, agriculture cannot afford to retain either superfluous or incapable workers, nor should it be expected to. The case of the former can only be met by expansion; the latter presents a purely social problem.

6.—Summary and Conclusion.—In this article an attempt has been made to suggest the kind of education which should be provided for the young worker and prospective farmer in order to improve labour and the efficiency of its work on the farms of this country.

As regards the better education of the worker, it is considered necessary to begin with the child at school. By means of vocational guidance, based on job analysis, individual child study and farm classes, it is believed that more children of the right type could be led, without coercion, to take up and enjoy agricultural work *under decent conditions*. The importance of instruction during the early years of employment is emphasized, and a sort of apprenticeship, involving education and training on or in association with the farm, is suggested. The nature of the training and education is explained, the main object being to ensure that the young worker shall be well informed in regard to his job and to enable him to advance as far as his abilities and the conditions of agriculture permit.

Since the efficiency of labour must always be largely determined by the methods of management, the education of the prospective farmer is no less important than that of the worker. One is in fact useless without the other. Under the headings of Seasonal Unproductive Time, Job Unproductive Time, Productivity of Productive Time, and Relations between Farmer and Worker, an attempt is made to compress into small compass the kind of information regarding labour management that should be instilled into the mind of the prospective farmer. Many of the points should also be specifically included in the instruction of the worker whenever it is possible to do so. Throughout the article it is made evident that the main objective is to create, in both farmer and worker, a new attitude of mind rather than to load the mind with a mere assembly of facts.

The effectiveness of the kind of education outlined is about to be tested. It is, however, highly necessary to realize that education in labour management constitutes only *part* of what should be the farmer's education for management. There is the working of the farmer's mind, and the knowledge required, in relation to *everything* to be considered: we need to know exactly what his education in its *entirety* should consist of—and how he is to get it. This at present is not definitely known. It is the problem which the present writer is primarily interested in, and which is being investigated at the South-Eastern Agricultural College, Wye, with some considerable prospect of success.

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FERTILIZER TRIALS IN 1929

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IN continuation of the programme of fertilizer trials carried out on ordinary farms by the staff of the Rothamsted Experimental Station, of which an account was given in a previous issue of this JOURNAL,[1] a further series of trials was arranged in 1929. As was indicated in the last report, experience has shown that it is possible to lay down experiments of the modern randomized type on private farms in various parts of the country, and to reach results of an accuracy comparable with that of the trials regularly made at Rothamsted and Woburn. There are obvious advantages in repeating the same trial at a number of centres, where the variety of soil and climate combine to throw light on the specific points tested in a way that is not possible at a single centre. The experiments are of two kinds: (*a*) those in which direct contact is observed between the Rothamsted Staff and the farmer, and in which the experiment is laid out and carried through from Rothamsted, and (*b*) those in which the co-operation of County Organizers, or the staff of Agricultural Colleges, and in some cases of private individuals is secured, and while the scheme of trial and general lay-out is provided by Rothamsted, the complete management

[1] For references see page 802.

is left to the individual concerned. The authors wish to record their deep indebtedness to the several authorities and individuals who have co-operated in this way. Their names, and those of the farmers who have assisted us by the provision of sites and labour, and whose co-operation at all stages has been most valuable, are given in the reports which follow.

The experiments are mostly of the Latin Square type, in which there are as many replications of each treatment as there are treatments, while each treatment occurs once and once only in each row and column of the square. Two experiments in 1929 were, however, of the randomized block type, a type which is suitable when it is desired to test all possible combinations of a number of treatments, and where owing to the larger number of treatments economy dictates that the number of replications shall be fewer than the number of treatments.

Use of the Standard Error in the Summaries of Results.—The nature of the general significance of the results of an experiment is determined from statistical examination of the yield figures, the details of which are too technical to give in full, and the statements as to the results of the trial are based on this examination. A figure giving the "standard error" of the mean yields for the respective treatments is, however, added to the summaries of results which follow, and the usual criterion for significance is that a difference between two mean yields should be equal to three times the standard error given in the table. When once the effect of the treatments has been shown to be definitely significant, therefore, individual differences may be examined in the light of their standard error, but it should be pointed out that this is not the only test applied, and in particular that certain differences may exceed the limit set for significance even although the effect has not been proved beyond question to be real by the fuller analysis which has been carried out. On the other hand, a definite progressive rise in yield due to the application of increasing quantities of fertilizer may be satisfactorily demonstrated even although not all adjacent differences are as much as three times the standard error.

Basic Slag on Meadow Hay.—At the farm of Mr. B. W. H. Pratt, Brooke, Norfolk, the effects of three types of basic slag, of different solubilities in citric acid, were tested on hay in the fourth season. The experiment was a 4 by 4 Latin Square with ¼ acre plots. The soil is chalky Boulder Clay. The results of 1926-28 had shown that the effectiveness of the slags lay in the order of their citric solubilities, and that the observed

differences between the yields produced by the various types were significant. In order to maintain the yields and bring out the phosphatic effect, a basal dressing of 1 cwt. of sulphate of ammonia and 2 cwt. of 20 per cent. potash salts per acre was given to all plots in early March, 1929. Owing to the very dry season which followed, this dressing was probably inoperative, for the crop only amounted to 13 cwt. on the average.

The yields for 1929 and also for the full four years of the experiment are given in Table I.

TABLE I

NEW MEADOW HAY, BROOKE, NORFOLK, 1929

Average yield	*Control*	*Low-Soluble*	*Medium-Soluble*	*High-Soluble*	*Standard Error*	*Standard Error per cent.*
cwt. per acre ..	10·9	12·6	13·6	13·7	0·45	3·52
Av., 1926–29 ..	22·6	25·5	27·9	31·0	0·86	3·21*

It will be noted that all forms of slag are still definitely better than the control plots in the fourth season, but though the slags still range themselves in the order of citric solubility the differences between the various types are smaller than in previous years. The figures for the whole four years of the experiment show a certain response to all types of slag, high-soluble slag being definitely better than both the others, and medium-soluble being very probably better than low-soluble. In any case the possible difference between medium and low-soluble slags is only of theoretical interest, for very little slag of medium solubility is on the market.

In this experiment the hay yields over the four seasons have amply repaid the cost of manures. Thus taking the high-soluble type as being the one in most general use, 100 lb. P_2O_5 in this form costs about 20s. after allowing for carriage, cartage and distribution. The return for this expenditure is 33.6 cwt. of hay, which is therefore obtained at a cost of 12s. per ton.

The fourth year of an exactly similar experiment was completed on the farm of Mr. E. Habberfield (Enmore, Somerset), with the assistance of Mr. Dallas, the soil being a red clay loam on sandstone. The figures for the final year, 1929, and for the average of the four years are given in Table II.

The action of slag is much smaller at this centre than at Brooke, but the response to phosphate has been shown to be real. Placing the weight of the produce against the cost of manure as before, the high-soluble slag gives 14 cwt. of hay at a cost of about 28s. per ton.

*These are the standard errors of the average results over four years, and show that nearly all the error is due to permanent characteristics of the plots.

TABLE II

OLD MEADOW HAY, ENMORE, SOMERSET, 1929

Average yield	*Control*	*Low-Soluble*	*Medium-Soluble*	*High-Soluble*	*Standard Error*	*Standard Error per cent.*
cwt. per acre ..	20·0	22·5	23·5	22·1	0.99	4·51
Av., 1926–29 ..	20·7	23·3	25·4	24·2	1·13	4·83

An examination of the full results of both trials shows a definite response to phosphate and, at Brooke, the superiority of the medium- or high-soluble product.*

Superphosphate on Potatoes.—Attention has been directed to the effect of increasing applications of superphosphate on the yield of potatoes by Mr. J. C. Wallace (Kirton),[2] who came to the conclusion that on the silt soils of Lincolnshire the high dressings of superphosphate customary in that district could be reduced without detriment to the crop. These experiments were repeated on various soils in a series of 4 by 4 Latin Squares in 1928, and continued in 1929. The results are collected in Table III.

In 1928, the effect of superphosphate was considerable on the black fen soil and on the light sand at Woburn; in the first case 8 cwt. of superphosphate yielded 89 cwt. of potatoes at a cost of 4½d. per cwt., in the second 9 cwt. of superphosphate gave 49 cwt. at a cost of 9d. per cwt. At Wisbech the effect was small, but just significant, and at the other two centres the effect of phosphate was not significant. In 1929, a repetition of the experiments at Owmby and Bangor confirmed their negative results; and in each case a higher degree of precision was reached than in the year before. At Wisbech there was a more marked increase for superphosphate, 2½ cwt. producing 16 cwt. of potatoes at a cost of 7½d. per cwt., and 10 cwt. producing 29 cwt. of potatoes at a cost of 1s. 5d. per cwt.

Enough has been done to show that the need for phosphate varies considerably with local conditions, and further work over a range of soils and seasons is desirable to follow out this question in detail. The series of results given in the table provide a good measure of the degree of accuracy to be expected from 4 by 4 Latin Squares conducted on potatoes.

* A new kind of low-soluble slag is now being manufactured which is different from the Fluorspar type used in the above experiments. The results discussed above only apply to the Fluorspar slags; the agricultural value of the newer type is now being ascertained.

TABLE III

EFFECT OF SUPERPHOSPHATE. ALL CENTRES, 1927-29

POTATOES: TONS PER ACRE

Year	*Centre*	*Experimenter*	*Soil*	*No Super.*	*Single dose*[1]	*Double dose*	*Quadruple dose*	*Standard tons*	*Standard error per cent.*
1928	Stowbridge, Norfolk	J. H. L. Luddington	Black Fen ..	8·10	10·05	10·97	12·57	0·33	3·21
1928	Owmby Cliff, Lincs.	E. Arden and J. A. McMillan	Oolitic limestone ..	8·18	6·79	7·73	7·25	0·27	3·66
1929	Owmby Cliff ..	"	" ..	7·42	7·44	7·34	7·30	0·15	2·07
1928	Bangor ..	E. J. Roberts	Light gravelly loam ..	15·78	15·62	16·12	16·03	0·36	2·27
1929	Bangor ..	"	" ..	14·66	14·25	14·53	14·66	0·18	1·22
1929	Midland Agric. Coll.	H. G. Robinson	Light loam ..	8·00	7·82	7·63	7·97	0·22	2·81
1928	Wisbech ..	G. Major ..	Deep silt ..	16·98	17·32	17·55	17·75	0·27	1·54
1929	Wisbech[2] ..	" ..	" ..	11·67	12·48	12·82	13·11	0·15	1·17
1927	Woburn[3] ..	—	Light sand ..	4·06	4·10	3·96	4·08	0·11	2·62
1928	Woburn[3] ..	—	" ..	12·25	13·43	14·00	14·69	0·27	2·00

1 Single dose usually 2 cwt. superphosphate per acre.
2 Single dose 2½ cwt.
3 Single, double and treble doses, unit 3 cwt. in this case.

The mean standard error of the ten experiments is 0·23 tons or 2·26 per cent. On the usual convention therefore a difference of 14 cwt. between mean yields can be detected. This may still appear to be a large difference, but it shows by contrast how slender must be the basis for demonstrating differences from experiments of the single plot type, which under the most favourable circumstances would have to be at least double this amount to be significant. Even with duplicate plots, as usually handled, the increase in precision is relatively slight.

A new type of experiment was undertaken in this series at the Wisbech centre, where it was desirable to ascertain whether different varieties of potatoes showed different degrees of response to phosphatic manuring. For this purpose each column of the 4 by 4 Latin Square was sown half with King Edward and the remaining half with British Queen seed, the actual order of the varieties within the column being at random. The arrangement is shown in Figure I.

A B	B A	B A	A B
3	1	2	4
4	2	1	3
2	4	3	1
1	3	4	2

Figure I

Key to treatments :—

1 No superphosphate.
2 2½ cwt. super. per acre.
3 5 cwt. ,, ,,
4 10 cwt. ,, ,,

Columns marked A and B were planted right through with British Queens and King Edwards respectively.

The average yields in tons per acre are given in Table IV.

TABLE IV

	No Super.	2½ cwt. Super.	5 cwt. Super.	10 cwt. Super.
King Edward ..	12·60	13·28	13·69	13·88
British Queen ..	10·74	11·67	11·95	12·34

Statistical examination showed that there was a significant response to superphosphate on both varieties, but no differential response. King Edward was definitely superior to British Queen in yield. The most striking difference between the varieties in this experiment was the very much greater proportion of potatoes of ware size yielded by King Edward.

Experiments on Sugar Beet.—On Col. Wilson's farm near Colchester two 4 by 4 Latin Squares were laid down testing nitrogenous and potassic fertilizers respectively. The soil at this centre is a very light loam and sugar beet is extensively grown. In the nitrogen series, nitrate of soda and sulphate of

ammonia were compared in equal nitrogen in presence of a basal dressing of dung, phosphate and potash. The results are given in Table V.

TABLE V

	Roots tons	*Sugar per cent.*	*Tops tons*
No Nitrogen	7·02	18·03	5·16
2 cwt. Sulphate of Ammonia with seed	7·97	17·86	5·97
2⅔ cwt. Nitrate of Soda with seed	8·35	17·78	6·81
2⅔ cwt. Nitrate of Soda top dressed	8·28	17·81	7·18
Standard error	0·213	0·078	0·167
Standard error per cent. ..	2·69	—	2·66

All nitrogenous dressings gave significant increases in yield of roots and tops, but the only certain difference between forms of nitrogen was the greater effect of nitrate of soda on leaf production. There were indications that the nitrogenous fertilizers tended slightly to reduce the sugar content. The increases due to nitrogenous manuring were remunerative. Setting the value of roots and tops against the cost of manure and application, the sulphate of ammonia treatment leaves a balance of 32s. per acre and the nitrate treatments 50s. per acre in each case.

The potash experiment was designed to compare muriate of potash with low-grade potash salts and with agricultural salt equivalent in chloride to the potash salts, in the presence of a basal dressing of superphosphate and sulphate of ammonia. The yields are given in Table VI.

TABLE VI

	Roots tons	*Sugar per cent.*	*Root/Tops (from 4 plots)*
No Potash or Salt	5·92	17·64	83
2 cwt. Muriate of Potash ..	6·49	17·63	92
Equivalent 20 per cent. Potash Manure Salts	7·62	18·00	124
Agricultural Salt	6·87	17·84	87
Standard error	0·256	0·161	—
Standard error per cent. ..	3·80	—	—

Muriate of potash gave a small, and salt a larger increase in yield, while potash salts were significantly better than either potash or salt alone. The addition of salt gave a profit of 47s. per acre, muriate of potash 15s., while 20 per cent. potash salts left a gain of 73s.

A further experiment on sugar beet presenting certain points of interest was carried out by Mr. C. Harrison in the school garden at the County School, Welshpool. The system of replication was four randomized blocks of 4 plots each,

the plots being exceedingly small (1/160 acre). This trial showed that, given care, useful and significant results could be obtained in such a small scale trial. Three nitrogenous treatments were compared in presence of a basal dressing of dung, phosphate and potash. The yields are given in Table VII.

TABLE VII

	Roots *tons*	*Sugar* *per cent.*	*Tops* *tons*
No Nitrogen	11·6	17·90	16·5
3 cwt. Sulphate of Ammonia	13·5	17·21	21·1
Equivalent Muriate of Ammonia	12·8	17·66	20·3
Equivalent Cyanamide ..	13·8	18·06	19·2
Standard error	0·26	0·30	0·93
Standard error per cent. ..	1·98	—	4·81

All nitrogenous treatments gave significant increases in roots and in tops, but no certain effect on the sugar percentage. Muriate of ammonia was definitely inferior to the other forms in yield of roots.

Experiments on Barley.—Cereals have always presented a difficult problem to the field experimenter who is operating away from his base owing to the difficulty of securing the accurate thrashing of the produce of small areas. This has now been overcome by a sampling method worked out at Rothamsted by A. R. Clapham.[3] A random sample is taken from each of the plots immediately before harvest, the constituent units being the produce of metre rows which are defined by the use of a suitably marked rod laid down along certain drills chosen at random. For greater accuracy the metre row is actually made up of two divided half metres marked along the rod and separated by a length which is neglected. The procedure is to cut off the corn standing between the marks on the rod, leaving a stubble of the ordinary length. The produce of the two half metre rows is combined by placing the ears in a paper bag, the mouth of which is secured round the straw with a tie-on label. The bagged produce of the metre rows is then put up in bundles by plots and taken to headquarters. It is allowed to dry off under cover and thrashed out in a specially constructed small machine,[4] the sheaf weights and the corresponding dressed grain weights being taken.

If an estimate of the sampling error is required, and this is always desirable, the small sheaves from metre rows may be thrashed out separately or in several groups per plot. Otherwise a figure for yield may be obtained if the metre samples

are bulked for each plot and thrashed out all together. This reduces the work, but the magnitude of the sampling error is unknown; an estimate of the total experimental error may still, however, be obtained. Working in this way a trial with sulphate of ammonia, sulphate of potash and superphosphate in all combinations was conducted on barley on the farm of Mr. H. G. Nevile at Wellingore, Lincs. The plot arrangement was two randomized blocks of 8 plots each. The soil is a light loam on the Lincoln Heath. The yields in cwt. per acre are given in Table VIII.

TABLE VIII

		Grain	*Straw*
No Manure	O	18·8	16·3
1 cwt. Sulphate of Ammonia ..	N	19·5	17·9
3 cwt. Superphosphate ..	P	18·0	16·4
1½ cwt. Sulphate of Potash ..	K	20·7	18·1
Nitrogen and Potash	NK	20·6	19·7
Nitrogen and Phosphate ..	NP	22·4	20·7
Phosphate and Potash ..	PK	17·0	14·7
Nitrogen, Phosphate, Potash ..	NPK	25·1	24·1
Standard error		0·89	0·59
Standard error per cent. ..		4·38	3·20

The experiment was laid down chiefly to test the sampling method on an outside farm. Fortunately the effects due to manuring were large and a number of significant differences occurred. Using the usual symbols these may be expressed as follows:—Grain: NP better than O or P or N; NPK better than K or NK or PK. PK worse than K. Straw: as grain, and also NK better than N, NPK better than NP. Comparison of the single and combined effects of N and P provides a good case of the interaction between fertilizers. Singly each is ineffective, together a marked increase is obtained.

A 4 by 4 Latin Square was carried through on barley by Mr. J. M. Templeton at the Sparsholt Farm Institute, comparing the effect of muriate of potash with that of agricultural salt. The results, in cwt. per acre, are given in Table IX.

TABLE IX

No Potash, no Salt	23·9 cwt.
Muriate of Potash, 1 cwt.	23·5 cwt.
Salt, 100 lb.	24·1 cwt.
Salt, 300 lb.	24·4 cwt.
Standard error	0·74 cwt.
Standard error per cent.	3·08 cwt.

In spite of a very accurate experiment no response to the manures was obtained in yield. When the percentage of nitrogen came to be examined it was found that this was rather higher where the chlorides had been given, and definitely so in the case of the heaviest dressing.

Labour and Personnel.—It is frequently urged against replicated experiments that an excessive amount of labour

and supervision is required. More labour must be expended per treatment on a replicated than on a single plot trial, but undoubtedly there is a much greater chance of obtaining useful results by the former method, particularly if small differences are looked for. It may be of interest to put on record (Table X) the labour expended in the replicated experiments on outside farms conducted by the Rothamsted Staff. These rates are intended as a rough guide only and will be corrected in the light of further experience. They are expressed in terms of sixteen plots, the least number likely to be put down in a replicated experiment. A supervisor will be occupied in all operations and will usually lend a hand with the work, so that he is included in the number of men.

TABLE X

Operation	*No. of men*	*Average size of plots acres*	*Time for 16 plots hours*	*Remarks*
Weighing and mixing manures	2	1/23	1¼	
Laying out plots ..	2	1/35	1	
Applying manures by hand	2	1/36	1¼	
Weighing hay (tripod)..	3	1/10	8	2 ton crop.
Harvesting barley ..	2	1/60	9	Sampling method (320 metre rows): good condition.
Picking and bagging potatoes	10	1/50	3½	8 pickers, 2 supervisors. Ploughed out.
Weighing potatoes on plots	4	1/50	¾	Heavy crop, 12 tons.

One of the most vital factors for success in this work is the willing co-operation of the farmer and his foreman, which can be secured by full discussion of the objects and details of the experiment and the utilization of all the intimate knowledge of land and cropping which their experience can provide.

The writers desire to record their indebtedness to Capt. E. H. Gregory for much valuable assistance in the carrying out of the experimental programme.

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THE INFLUENCE OF THE FAT-CONTENT ON THE KEEPING QUALITY OF MILK

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IN all branches of the dairy industry there are those who hold that "rich milk does not keep so well." An attempt has been made to investigate this belief, approaching the matter from the comparatively simple standpoint of the butter-fat content as determined by the Gerber test. For this purpose samples were divided into three classes: below 3·00 per cent. butter-fat, 3·00-4·00 per cent. butter-fat (both inclusive), and those with a fat-content of over 4·00 per cent. The table gives a summary of the results.

Material was found in the results of clean milk competitions extending from 1923-1929. All samples are from mornings' milk received at the laboratory on the morning after production and tested for bacterial count when 27-28 hours old. No samples arriving later than that time are included, and only a few samples arrived at the laboratory on the same day that they were produced. Any such samples were kept overnight and tested at the same age as the others. Only a few samples gave arrival temperatures of over 60° F.

In order to put all samples on the same footing it has been necessary to tabulate them according to their nominal quarter-days:[1] and from this the average keeping quality has been calculated as true life,[2] on the assumption that all herds start milking at 6 a.m. giving an official "milking time" of 6.30 a.m. All herds are not, of course, milked at exactly the same time, but the variation is small in the case of the morning milking time, and an examination of data indicates that the times given represent very fairly the conditions in the area concerned. For the comparative purpose that we have in view, the differences caused by the use of a fixed milking time are not important, but the resultant average keeping qualities are, of course, not strictly comparable with figures obtained where the actual milking time has been recorded in each case.

In addition to samples from the South-Eastern Province, the table includes 1,262 samples, the results of which were supplied by Mr. L. J. Meanwell, of the National Institute for Research in Dairying.

Minor variations in the total number of colonies are not significant, and while there is a general relationship between the total count and the period of sweetness, variations in the

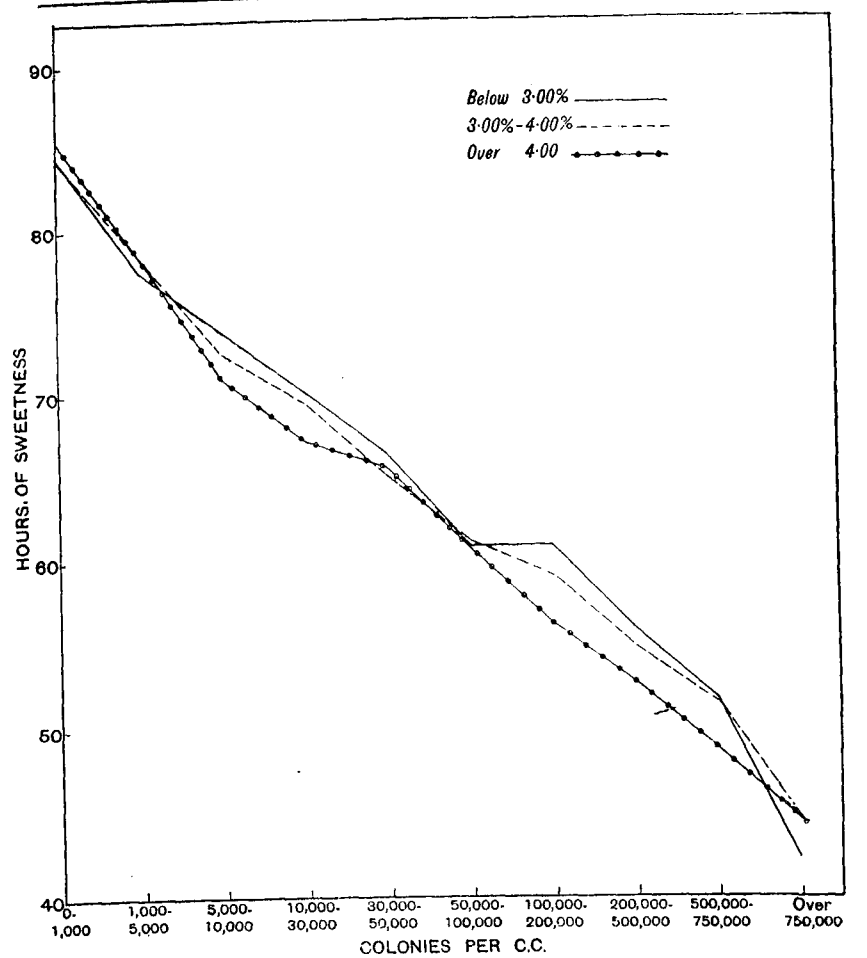
TABLE I.—EFFECT OF FAT CONTENT ON KEEPING QUALITY

Colonies per c.c.	Under 3·00% fat		3·00-4·00% fat		Over 4·00% fat	
	Total samples	Av. hr. of sweet-ness	Total samples	Av. hr. of sweet-ness	Total samples	Av. hr. of sweet-ness
0-1,000	204	84·7	436	84.6	178	85·7
1,000-5,000 ..	191	77·6	421	78·4	153	78·4
5,000-10,000 ..	99	73·9	207	72·5	72	70·9
10,000-30,000 ..	124	70·2	286	69·4	115	67·1
30,000-50,000 ..	39	66·3	101	65·0	49	65·5
50,000-100,000 ..	40	60·85	129	61·2	57	60·7
100,000-200,000 ..	37	60·9	106	59·2	38	56·3
200,000-500,000 ..	42	56·0	125	54·9	44	52·8
500,000-750,000 ..	13	51·8	47	51·6	15	48·8
Over 750,000 ..	133	42·1	395	44·9	106	44·7
Totals ..	922		2,253		827	
	4,002					

period will occur owing to types of bacteria as opposed to numbers. Lastly, it will be obvious that the greater the total number of bacteria present the larger the increase required to make a significant difference. For these reasons it is usual to collect together the results of all samples of approximately the same count arranging thereby "count groups," which have a small range at the start and increase in range as the total count increases. In Table I, ten such count groups are made and the range in each case is given. In addition to recognizing total count and keeping quality the samples were further sub-divided according to their fat content. The net result of this treatment is shown in the table and also graphically.

Although the figures extend over a period of six years, the totals in some groups are still small, but it seems reasonable to assume that if a high butter-fat content in itself had any serious effect on the keeping quality of milk, this would be reflected in such a table.

In the particular figures before us, there is a suggestion that, while the keeping quality is not affected so long as the bacterial content is really low, there is a tendency for the samples of fat-content of over 4·00 per cent. to lose in average keeping quality as the count increases. The loss indicated is in the nature of 2-3 hours only, this period not amounting to a commercial factor.



In laboratory tests, milks are tested for sweetness at 9 a.m. and 5 p.m., and, in commercial practice, it is unlikely that a churn of milk would remain undisturbed for a longer period. The longer milk stands, the more compact the cream layer and the better the anaerobic condition in the milk underneath. This may be a factor, but no definite explanation of any loss through high butter-fat content is at the moment proven. In speaking of "rich" milk, the dairyman often implies points other than mere fat-content. The term may also cover ability to throw a deep cream layer, to give a clear demarcation between the cream-layer and the residue, and may even include colour. The fat-content has a bearing on the first two of these points, but temperature factors are also concerned. Breed is a factor in all three cases, though colour may be slightly influenced also by diet.

Whatever the causes, the figures before us indicate that if rich milks are considered in terms of butter-fat content they lose little if anything in keeping quality as compared with milks of lower fat content.

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A SUCCESSFUL FARM IN EAST SUFFOLK

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THE following notes on the methods adopted by an East Anglian farmer, who has, up to the present, been successful in obtaining a small profit from his holding, may be of interest to other agriculturists in the very difficult conditions which now prevail.

The farmer in question, who is a farmer's son, was educated at a local secondary school and subsequently took a short course of training at an agricultural college. In 1918, he commenced operations as a tenant farmer some four miles from a market town, his holding comprising 170 acres, 30 being under grass and the rest arable. The soil is a good heavy loam containing plenty of lime, the geological formation being chalky Boulder Clay. Like the generality of upland grass in the dry Eastern Counties, the pasturage is not very productive, doubtless on account of the low rainfall. Despite treatment with basic slag, it carries little stock during a dry season. Indeed, so low is its productivity that it would probably be impossible to make a living from the holding if a large proportion of the land were under grass. One-year leys give far better crops of hay than the permanent meadows. The arable land is typical of the district, being well suited for the growth of wheat, barley, oats, beans, peas, lucerne, mangolds and sugar beet.

Livestock.—Great importance is attached by this farmer to the maintenance of a large head of live stock. Usually, he keeps seven working horses and three young horses, all pure-bred Suffolks, and he aims at having from one to three foals annually. Each year, one of the young horses, at the age of two years, is broken in. The cattle usually include 12 to 15 bullocks, which are fattened during the winter, two cows, which are kept to supply the household with milk, and one calf. The pigs number 200, including 20 Large Black sows which are crossed with a Large White boar. All the piglings are fattened.

There is a mill on the holding, in which all the corn, both home-grown and purchased, is ground for the stock. From an economic point of view, this arrangement has proved more satisfactory than purchasing meal. An oil engine supplies the power for the mill, although the farmer considers that it could be driven more economically by a tractor. The principal foodstuffs used are maize, barley and middlings as carbohydrate foods; peas, lentils and beans for protein; and fish meal as a source of animal protein and of minerals. No compound foodstuffs are purchased. A usual fattening ration for pigs consists of 65 per cent. maize or barley, 15 per cent. middlings, 15 per cent. leguminous corn (peas, beans or lentils), and 5 per cent. fish meal. On account of the low prices ruling last year, nearly all the corn produced, other than wheat, was used on the farm. In buying foodstuffs, manures, seeds and other supplies, a point is made of securing the discounts allowed by most firms for cash payments; it is realized that, spread over a year, these total up to a considerable percentage of the expenditure on these essentials.

More than 1,000 head of laying hens are kept, chiefly Rhode Island Reds and Leghorns. The poultry department has recently been increased. A considerable number of day-old chicks are sold during the season, and incubators having a capacity of 2,500 eggs are employed for hatching. Eggs for sittings are sold in considerable quantity. Eggs are also graded and sold to London customers, any surplus being disposed of at a local market. There are 2 colony poultry houses with free range, while others are small huts on wheels for use with wire pens. They are moved on to the stubbles in the autumn. Houses with slatted floors are being adopted, each house to hold 60 to 80 hens. Some of the houses are home-made, and the others were made locally by a village carpenter. One man is employed almost the whole of his time with the poultry, a boy helps and the farmer also gives his assistance and supervision. The poultry food consists chiefly of bran, middlings, maize meal, fish meal, whole wheat and cracked maize.

Recently, a small flock of grass-sheep has been purchased, the idea being that they would pick up a good deal that went to waste.

Arable Land.—The land, as previously stated, is mainly heavy, but it can all be ploughed with two horses on a single-furrow plough. A tractor is kept, and this is let out on hire when not required on the holding. Practically all the stubbles are broken up immediately after harvest in dry autumns, such as those of 1928 and 1929. In 1929, the tractor was kept going during harvest as soon as stubbles were available, one man being taken off harvest work and paid harvest wages to do the work. The tractor was not used on the binder as horses were available and it was considered more valuable for work elsewhere.

By means of autumn cultivation, combined with occasional pin or bastard fallows, it is found possible to keep the land clean without bare summer fallows. Bastard fallows are made after such crops as trefoil, or one-year grass mixtures, or after a rather thin plant of red clover which has been cut once and is not considered good enough to leave for seed. No fixed rotation is followed. Usually, about 30 acres each of wheat and barley are grown, with 10 to 12 acres of sugar-beet and 4 acres of mangolds. Beans, peas and various clovers are also grown, the clovers being frequently saved for seed. The land is somewhat heavy for sugar-beet, although good crops can be grown, but in a wet autumn it is rather difficult to get them off.

Manuring.—Farmyard manure is usually applied for beans and mangolds, and for other crops in the rotation when convenient. Artificials are used for any crop likely to need help. As the land is heavy, the addition of potash as an artificial fertilizer for most crops is not considered necessary. Superphosphate is generally used as a source of phosphate, and nitrate of soda to supply nitrogen. The soda in the latter fertilizer is regarded as liberating potash. The only compound manure in use is a proprietary mixture obtained from a local farmers' co-operative society for little more than the cost of the ingredients purchased separately. As a rule, cereals are given 2 to 3 cwt. of superphosphate and 1 cwt. of nitrate of soda per acre; leguminous crops often receive 3 cwt. of superphosphate per acre; and roots are given farmyard manure, superphosphate and nitrate of soda. Sugar-beet appears to do better if farmyard manure is applied to the previous crop.

Labour.—The labour employed is supplied by eight men and a boy. No family labour is utilized, apart from assistance and supervision in all departments by the farmer himself.

It is noteworthy that, on a medium-sized farm of this character, the farmer is in touch with all details, and that, except in prolonged periods of bad weather, he can generally keep all his men at remunerative work. For example, when the weather is too wet or frosty for land work, farmyard manure may be carted, being heaped if the land is wet, or spread during frost. Buildings, gates and posts, machines and appliances can be overhauled, and such minor improvements as putting in pumps and drains can be undertaken without the assistance of skilled tradesmen.

Generally.—The small average profit derived from this holding, over a period of 12 years, is probably the result of a combination of factors, of which careful and economical management is, no doubt, the most important. The land has been kept clean and heavily manured, and, in consequence, good crops have been obtained. The land is well managed, and of a type from which good crops can be expected except, perhaps, in particularly wet seasons. When grain prices have been low, most of the home production has been consumed by the large head of live stock kept, and when prices improved, the grain has been put on the market. Both pigs and poultry have paid fairly well and have taken up much of the home-grown grain, saving the necessity of marketing it. The bullocks, too, have probably left a small profit, as they have provided a market for roots, straw, etc., produced on the farm. Sugar-beet has been useful during the past few years, and, from time to time, small profits have been made from clover seed production.

* * * * * *

LICENSING OF STALLIONS UNDER THE HORSE BREEDING ACT, 1918

THE number of applications for licences for the year ended October 31, 1930, was 1,472, or exactly the same as in the previous year, but the number of licences issued decreased by 6 to 1,430.

Number of Stallions Licensed in England and Wales

Service Season	1924	1925	1926	1927	1928	1929	1930
Shires	1,195	953	829	772	720	760	752
Other heavy horses	424	350	324	328	313	329	335
Light horses (including ponies)	591	546	455	437	381	347	343
	2,210	1,849	1,608	1,537	1,414	1,436	1,430

Licences were issued in respect of 1,087 heavy stallions, a decrease of 2 on the year, but more Suffolks and Percherons

were licensed, the decrease occurring in Shires and Clydesdales. Suffolks numbered 139, an increase of 10, and Percherons 42, an increase of 1, while Shires declined by 8 to 752 and Clydesdales by 5 to 128. There were, however, this year, more licensed stallions of each of the four heavy breeds than in the year 1928.

As regards light stallions, the increase in the number of Thoroughbreds which occurred in each of the previous three years was continued, this year's figure of 184 being 18 more than in 1929 and 46 more than in 1926. Most of the other breeds of light horses showed decreases, Hackneys again declining sharply and numbering only 32 against 45 in 1929, while Welsh Cobs decreased by 5 to 32.

The Horse Breeding Act has now been in force since 1920, and a comparison of the numbers of stallions of different breeds licensed in 1930 with those of that year is of interest.

NUMBER OF STALLIONS LICENSED IN ENGLAND AND WALES IN 1920 AND 1930.

BREED OR TYPE	NUMBER LICENSED 1920	NUMBER LICENSED 1930	PERCENTAGE REDUCTION
			Per cent.
HEAVY—			
Shire	2,430	752	69·1
Clydesdale	296	128	56·8
Suffolk	197	139	29·4
Percheron	42	42	—
Other Heavy Horses	54	26	51·9
TOTAL HEAVY HORSES ..	3,019	1,087	64·0
LIGHT—			
Thoroughbred	185	184	0·5
Hackney	243	32	86·8
Welsh Cob	89	32	64·0
Other Light Horses and Ponies ..	213	95	55·4
TOTAL OF LIGHT HORSES AND PONIES	730	343	53·0
GRAND TOTAL	3,749	1,430	61·9

The total number of licensed stallions has declined in the 10 years by 62 per cent., the decrease being relatively sharper in heavy than in light stallions. Among heavy stallions the greatest percentage reduction is in Shires, while the number of Percherons has been maintained. Thoroughbreds show practically no change in the 10 years, but the decrease in Hackneys is exceptionally heavy, being nearly 87 per cent.

Licences were refused by the Ministry in respect of 42 applications for the 1930 season, an increase of 6 as compared with the previous season, but appeals against refusals were

lodged in only 5 cases against 12 in 1929. Of the 5 appeals 3 were successful. The breeds of the stallions rejected and the reasons for their rejection are given in the next table.

NUMBER OF APPLICATIONS FOR LICENCES NOT GRANTED AND GROUNDS OF REFUSAL, 1930.

BREED	Number Refused	Percentage Refused	DISEASE							
			Cataract	Roaring	Whistling	Ringbone	Sidebone	Shivering	Stringholt	Defective Genital Organs
PEDIGREE—		%								
Shire	24	3·3	3	6†	6	2	5‡	2	—	—
Suffolk ..	6	4·2	1	—	1§	1	2	—	1	—
Clydesdale ..	1	0·8	—	—	—	—	1	—	—	—
Percheron ..	2	4·5	—	—	1	1	—	—	—	—
Hackney ..	1	3·6	—	—	—	—	—	—	1	—
Thoroughbred	3*	1·6	—	—	—	—	—	—	1	1
NON-PEDIGREE—										
Heavy ..	4	4·8	—	—	—	2	1	—	1	—
Pony and Cob	1	10·0	1	—	—	—	—	—	—	—
TOTALS ..	42	2·9	5	6	8	6	9	2	4	1

* A licence was also refused in respect of a Thoroughbred stallion that had been "tubed" and could not, therefore, be examined for its wind.

† 1 also affected with Shivering.

‡ 1 also affected with Ringbone.

§ Also affected with Shivering.

The number of infringements of the Act reported during the season was the same as in the previous year, viz., 14. Three unlicensed stallions were found travelling for service, and two unlicensed stallions were reported as being exhibited on premises not in the occupation of the owners with a view to use for service. In four of these cases proceedings were taken by the police and convictions were obtained in three cases, while the fourth was dismissed under the First Offenders Act. Nine stallions, though licensed, were found to be travelling for service unaccompanied by the licences.

Stallion owners in possession of licences for the year ended October 31, 1930, are reminded that these licences expired on that date, and should have been returned to the Ministry. Applications for licences for the service season November 1, 1930, to October 31, 1931, should be made as early as possible

on forms which may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W. 1.

NUMBER OF APPLICATIONS FOR LICENCES AND NUMBER OF LICENCES GRANTED AND REFUSED IN ENGLAND AND WALES, 1930.

BREED OR TYPE	PEDIGREE (*i.e.*, Stallions entered or accepted for entry in the recognized Stud Book of their Breed)			NON-PEDIGREE (*i.e.*, Stallions not entered or accepted for entry in a recognized Stud Book)			TOTALS OF EACH BREED AND TYPE (Pedigree and non-Pedigree)		
	Applications	Licensed	Refused	Applications	Licensed	Refused	Applications	Licensed	Refused
HEAVY—									
Shire ..	730	706	24	48	46	2	778	752	26
Clydesdale .	123	122	1	6	6	—	129	128	1
Suffolk ..	143	137	6	3	2	1	146	139	7
Percheron ..	44	42	2	—	—	—	44	42	2
Others ..	—	—	—	27	26	1	27	26	1
LIGHT—									
Hackney ..	28	27	1	5	5	—	33	32	1
Thoroughbred ..	186	183	3	1	1	—	187	184	3
Arab ..	11	11	—	2	2	—	13	13	—
Cleveland Bay ..	3	3	—	—	—	—	3	3	—
Welsh Roadster	1	1	—	3	3	—	4	4	—
Hunter ..	2	2	—	1	1	—	3	3	—
Yorkshire Coach ..	2	2	—	—	—	—	2	2	—
Others ..	—	—	—	5	5	—	5	5	—
PONY AND COB—									
Welsh ..	14	14	—	—	—	—	14	14	—
Fell ..	14	14	—	—	—	—	14	14	—
Dales ..	12	12	—	2	2	—	14	14	—
Polo and Riding ..	11	11	—	1	—	1	12	11	1
Shetland ..	7	7	—	—	—	—	7	7	—
Highland ..	2	2	—	—	—	—	2	2	—
Welsh cob..	28	28	—	4	4	—	32	32	—
Others ..	—	—	—	3	3	—	3	3	—
TOTALS ..	1,361	1,324	37	111	106	5	1,472	1,430	42

MARKETING NOTES

National Mark Eggs.—During the past few weeks, the seasonal decline in egg production has had the effect of reducing the quantities of National Mark eggs on the market, with a resultant hardening of prices. In most districts, the demand for National Mark consignments, which has now become a permanent feature of the trade, has far exceeded the supply. It is evident that quality, in conjunction with publicity, is reacting favourably on prices ; National Mark " Standards " now show a price margin of as much as from 6*s*. to 7*s*. per 120 over the best imported eggs of comparable weight. This is the climax of a period beginning early last spring, in which, except for a brief interval late in August, National Mark eggs have steadily improved their relative position on the market.

It is important to remember that National Mark prices have also helped to lift the price level of ungraded eggs, so much so that, while producers have benefited, it has been difficult for authorized packers to obtain supplies that can be packed and sold under the Mark and at the same time give them a reasonable return for the services they are required to perform.

The progress of authorized packing stations during the past season is a matter of interest. It was not unexpected that some of the stations which, for various reasons—*e.g.*, severe local competition for supplies or lack of enterprise or of efficient management, etc.—have suffered financial loss on their working, should have withdrawn from the scheme. Others have been awaiting some statutory measure requiring the sale of eggs on the basis of weight or of statutory grade. Nevertheless, there are a number of stations that show a very encouraging increase in output ; reference may be made to one of the producers' co-operative stations that was formed for the purpose of working the National Mark Scheme, and has this year (*i.e.*, up to September 30) practically doubled its output, packing approximately 95 per cent. of it under National Mark labels. Such a development at one centre illustrates the potentialities in the National Mark Scheme when efficiently and energetically applied.

A further pointer to the growing importance of the Scheme is to be found in the fact that three competition classes for National Mark eggs were this year, for the first time, instituted in connexion with the Dairy Show held at the Royal Agricultural Hall, London, from October 21 to 24. It is hoped to publish a report upon these competition classes in the next issue of this JOURNAL.

National Mark Beef.—The number of sides (including quarters and pieces in terms of sides) of beef graded and marked with the National Mark for the five weeks ended October 25 was as follows :—

Week ended	*Select*	*Prime*	*Good*	*Total*
		LONDON		
September 27 ..	682	1,023	20	1,725
October 4 ..	749	1,149	20	1,918
,, 11 ..	706	1,009	42	1,757
,, 18 ..	759	1,006	30	1,795
		BIRKENHEAD*		
September 27 ..	114	542	1	657
October 4 ..	202	387	7	596
,, 11 ..	141	540	6	687
,, 18 ..	211	479	4	694
		SCOTLAND*		
September 27 ..	1,741	598	—	2,339
October 4 ..	1,872	760	—	2,632
,, 11 ..	1,580	742	—	2,322
,, 18 ..	1,320	688	—	2,008
		TOTAL LONDON SUPPLIES (*All Sources*)		
September 27 ..	2,537	2,163	21	4,721
October 4 ..	2,823	2,296	27	5,146
,, 11 ..	3,427	2,291	48	4,766
,, 18 ..	2,290	2,173	34	4,497
		BIRMINGHAM		
September 27 ..	22	147	15	184
October 4 ..	34	198	19	251
,, 11 ..	69	289	13	371
,, 18 ..	51	265	42	358

* Sides consigned to London.

There was a steady demand for National Mark beef from London retailers during September.

During September, also, one or two more truck-loads of cattle were sent direct from farms to the Islington Abattoir, for sale on the basis of dead-weight and National Mark grades. The proportions of live weight to dead weight of these grass-fed cattle are of some interest. One truck-load of eight Welsh Blacks weighed 681·7 stones (14 lb.) live weight, and 704·2 stones (8 lb.) dead weight, thus showing an average "gain" of about 3 stones; a second consignment weighed 638 stones live and 663·5 stones dead. It has to be remembered that the cattle are weighed alive at Islington after a journey, when they are bound to weigh less than they would have weighed on the

farm. An average "gain" of 3 stones must, however, be regarded as satisfactory for this class of cattle. The majority of them were graded "Prime." It is hoped that more farmers will take advantage of this system of sale. Dead-weight quotations for cattle under the direct consignment scheme can always be arranged by the Ministry for intending consignors.

In Birmingham, as the figures show, the National Mark beef scheme has been steadily recovering from the local difficulties created by the wholesale meat salesmen at the end of May. A largely increased number of meat shops are now regularly selling National Mark beef.

Report of the Inter-Departmental Committee on the National Mark Beef Scheme.—A report of great interest to farmers has been presented by the Inter-Departmental Committee which was appointed in April last by the Minister of Agriculture and Fisheries and the Secretary of State for Scotland to review the progress made by the English and Scottish scheme for grading and marking beef.

In the Committee's opinion, the expense that has already been incurred on the scheme has been more than justified. In London, where the scheme has had a fair trial, the Committee shows that it was accompanied by a marked increase in the supplies of high-quality Scotch beef bought at Smithfield Market. Whereas in the months of December to May, 1928–29, the tonnage of Scotch beef at Smithfield was 7,250 (approximately valued at £650,000), in December to May, 1929–30, the corresponding tonnage was 8,758 (valued at £812,000). In the case of home-killed (English and Irish) beef, there was no actual increase in the quantities, but the value of the supplies rose by £55,000. An analysis of the grading of the London area reveals the fact that the scheme has caused a notable increase in the general level of quality. Thus, in October, 1929, there were 533 "Select," 3,754 "Prime" and 1,878 "Good" sides graded at Smithfield. The proportions of the various grades had changed to a marked extent by the spring of 1930. The figures for May were 2,248 "Select," 4,506 "Prime" and 315 "Good." Other tables in the report indicate the steadying influence of the National Mark scheme on wholesale prices, and the improvement in the price of English "Select" during the period of the scheme's operation. These figures are distinctly encouraging.

The Committee accordingly recommends that the existing schemes should be continued on the present experimental basis in London (including supplies from north-east Scotland and from Birkenhead) and in Birmingham up till October 31,

1931, and should be extended on the same basis for twelve months to the Leeds area and an area in South Wales, and to Edinburgh and Glasgow. The Manchester area should be considered for extension when a start has been made in the new areas. Further expansion depends, in the Committee's view, largely on the development of centralized slaughtering in the large towns.

Both the National Farmers' Union of England and Wales and the National Farmers' Union of Scotland gave evidence in support of the scheme, and stated that the beef-producing farmers were anxious that the scheme should be pushed forward.

No change is suggested in the existing grades—"Select," "Prime" and "Good"—although the Committee recognizes that when the scheme is extended to the Manchester area some modification as regards finish may be necessary to meet variations in demand. The advantages of the scheme in bringing the farmer into closer touch with the demands of the market are stressed.

The Committee approves the methods of publicity adopted by the Departments concerned, but considers that the volume of publicity has been inadequate and that, with the extension of the scheme, more preliminary and sustained advertisement should be given to it. In this connexion, the Committee remarks that, apart from State-aided publicity, home beef-producers, if they will organize comprehensively for the purpose, have been given, in the grading and marking scheme, a new and great opportunity to advertise their goods effectively.

Where, as in Birmingham, the support of the scheme by distributors cannot be relied on, the Committee considers that it would be feasible to make grading and marking compulsory in the consuming area concerned, and that as part of a compulsory scheme provision should be made for the payment by traders for the grading service.

The cost of grading has varied considerably since the start of the scheme in different areas. This was inevitable in view of the varying conditions met with. It is estimated, however, that in a provincial centre when the scheme is in full operation, the cost should not exceed 6*d.* to 8*d.* per side of beef. When the scheme has proved its value to producers and distributors, the whole or a substantial proportion of the expense should, in the Committee's view, be borne by the product.

Various other matters bearing on the National Mark scheme are discussed in the report. In particular, the Committee regards

as of considerable importance the experiments in fat-cattle marketing, on a carcass-grade and dead-weight basis, which have been carried on in London in connexion with the scheme, with the object of testing the advantages of sending stock direct from the farm to the abattoir and reducing intermediate charges. The suggestion is made that the Ministry, in conjunction with producers and distributors, should at a later stage consider the question of combining a scheme of insurance with this extension of the grading and marking service and charging an inclusive fee. The Committee points out that the greatest contribution which the farming community can make towards the success of the scheme is the improvement of the general average quality of British cattle, in particular by the elimination of the scrub bull.

Some representatives of the trade suggested that imported beef should be marked to indicate the country of origin. On this point, the Committee observes that such a measure, while militating against the sale of imported beef as English (and responsible representatives in the trade admitted that this was unfortunately a common practice), would make the National Mark beef scheme even more necessary than it is at present as a means of distinguishing between the superior and the inferior qualities of the home product.

The report,* which is unanimous and published as a Command Paper, is signed by the three members of the Committee, Lord Henry Cavendish Bentinck, Mr. George Dallas, M.P., and Sir Archibald Sinclair, Bart, M.P.

National Mark Apples and Pears.—Applications for enrolment under the National Mark apple and pear scheme continue to be received and are indicative of the good progress that is being made. The demand for National Mark fruit exceeds the supply, and the high prices now being realized for it in the wholesale markets contrast sharply with the quotations for ungraded and imported fruits.

National Mark Tomatoes and Cucumbers.—As a result of the quality guarantee afforded by the National Mark, coupled with the publicity which has been conducted by the Ministry, National Mark tomatoes and cucumbers have been in very large demand during the past season; in some cases, the demand has exceeded the supply, even at the peak of the season—in July. In spite of heavy importations, National Mark prices have been consistently good.

* Cmd. 3648/1930, to be obtained, price 9d. net, from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.2, or through any bookseller.

National Mark Canned Fruit, Peas and Beans.—The demand for National Mark canned fruit, peas and beans continues to be very strong. Many of the leading authorized canners are carrying out big advertising campaigns, in which preference is given to National Mark goods. Extensive sampling of the output of authorized canners has shown that a high standard of excellence has been maintained, while reports from the Fruit and Vegetable Research Station, Campden, where the samples are examined, have revealed close conformity with the points of quality defined in the statutory grade definitions for the various products.

A recent issue of *Grocery* contained a comment on the increasing popularity of English canned fruits—attributing this mainly to improvements in grading and general quality—as a result of which there has been less demand for Californian supplies.

National Mark Wheat Flour.—The results of the bread-baking competitions in connexion with the Bakers' and Confectioners' Exhibition, held at the Agricultural Hall in September, amply demonstrated the fact that National Mark all-English (Yeoman) flour will make bread that compares favourably with bread made from ordinary baker's flour. The competitions included two classes for bread made from National Mark wheat flour, one being for commercial milk loaves, for which three prizes were given by the Ministry. This class attracted 29 entries, which was about the average number of entries for all the milk-loaf classes. The other class was for plain commercial bread made from National Mark flour, the prizes being given by the National Farmers' Union and the Ministry. There were 89 entries in this class, this number being exceeded only by the Championship class in private competitions. Some excellent loaves were shown in both classes, and the judges commented very favourably on the high standard of quality attained by the entries as a whole.

Further reports have been received regarding the increased demand for National Mark flour in some localities. A prominent firm of grocers in Manchester with a large trade in flour reports that National Mark flour now comprises 13½ per cent. of its total turnover of flour. The firm sells mainly all-English (Plain); most customers use this flour for the home baking of bread, and it is noteworthy that up to the present they have been thoroughly satisfied with the results obtained. An authorized miller has sufficient confidence in the scheme to have placed an

order with his printer for 250,000 bags, specially designed for the trade in National Mark flour. This miller was among the first to apply for authorization in the scheme, and his experience during the first year's working has induced him to instal expensive new plant for packing National Mark flour in small bags.

National Mark Cider.—The Minister has made Regulations, entitled the "Agricultural Produce (Grading and Marking) (Cider) Regulations, 1930," prescribing grade designations and grade designation marks for cider.

The Regulations,* which prescribe two grade designations indicating the quality of cider made from apples and pears grown in England and Wales, will come into operation on November 10.

Publicity for National Mark Produce.—National Mark Weeks have been held at Southampton (October 4 to 11) and Llanelly (October 7 to 16), concurrently with the Southampton Industries and Trades Fair and the South Wales Grocery and Allied Trades Exhibition, respectively, at both of which an exhibition of National Mark products was staged by the Ministry. The tinplate industry of South Wales is closely interested in the continued expansion of the home fruit-canning industry, and National Mark canned fruit and canned peas and beans figured prominently in the Llanelly National Mark Week. Advertising in connexion with this Week covered a number of other towns in the district, including Swansea, where members of the local Grocers' Association made special displays of National Mark produce.

Wherever possible, shop window display competitions, for which the Ministry offers prizes, are organized in connexion with National Mark Weeks. Such a competition was held at Bradford during the Special Week in that town, September 24 to October 4—reference to which was made in the October issue of this JOURNAL—and a photograph of one of the winning displays is here reproduced.

The advertisements of National Mark beef, National Mark canned fruit, National Mark canned peas and National Mark malt extract with cod-liver oil, which are being shown on London omnibuses for several weeks, are attracting much attention. Photographs of two of these advertisements are reproduced here. Since this advertising campaign in London

* Copies of the Regulations may be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2., price 1d. net, postage extra.

commenced, considerable quantities of National Mark shop display material have been asked for by, and supplied to, large London stores and shops, particularly in connexion with special displays of home and other Empire goods arranged to coincide with the Imperial Conference.

Arrangements have been made with the Empire Marketing Board for special lectures on the National Mark to be included in the Board's list of lectures available to Women's Institutes and kindred organizations, by means of which it is hoped to foster the interest of women of the countryside in the National Mark scheme.

Displays of Home Produce.—In addition to the National Mark exhibits staged at the Southampton Industries and Trades Fair and the South Wales Grocery Exhibition at Llanelly during the National Mark Weeks referred to above, a display of home produce was staged in the Empire Marketing Board section at the Imperial Fruit Show, Leicester, October 24 to November 1.

Marketing Demonstrations.—Demonstrations in improved methods of marketing agricultural produce were given during October at :—

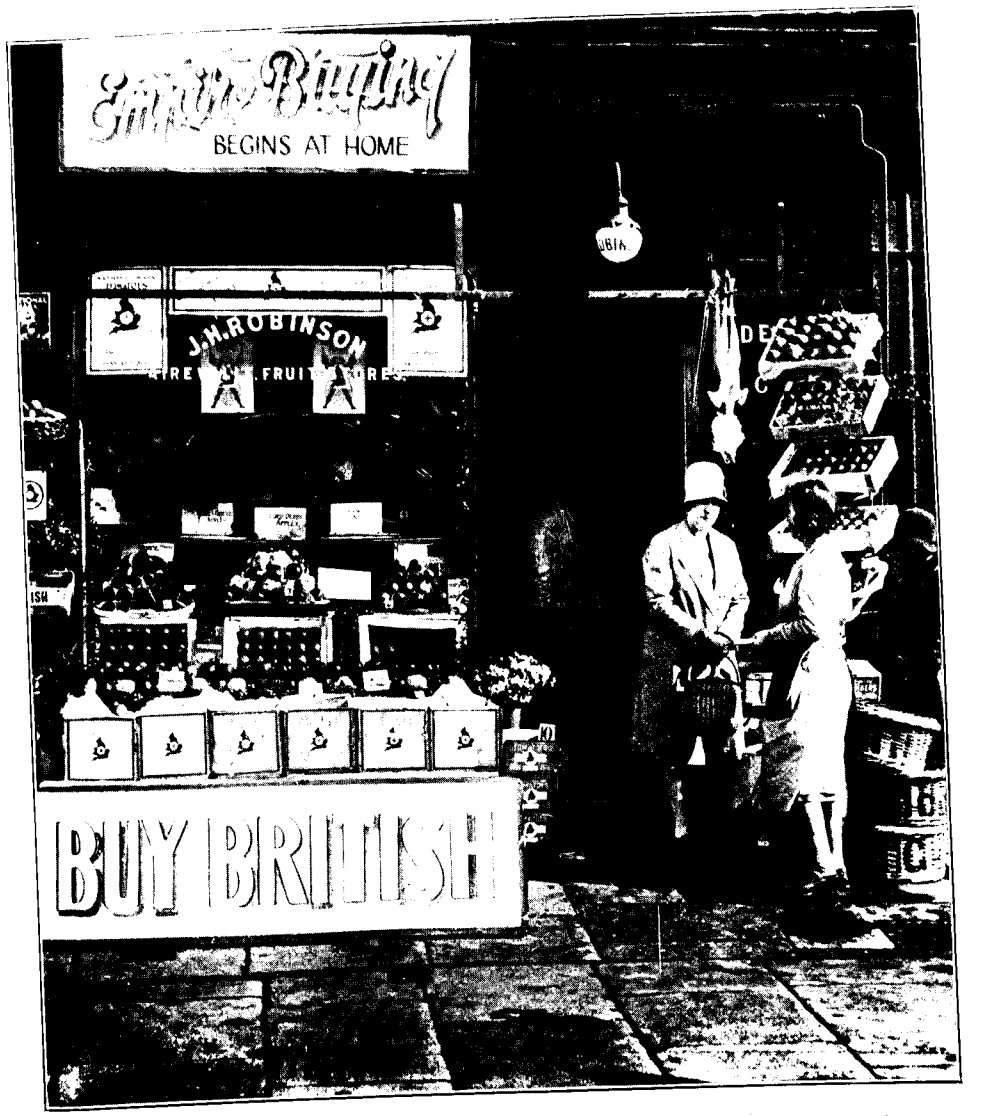
London Dairy Show, Agricultural Hall.	October 21 to 24 (Bacon and Cheese).
Imperial Fruit Show, Leicester.	October 24 to November 1 (Fruit).
Preston Cheese Fair.	October 28 (Cheese).

Demonstrations will be given during November as follows :—

Stoke-on-Trent Fat-Stock Show.	November 26 to 27 (Pigs and Bacon).
Birmingham Fat-Stock Show.	November 29 to December 4 (Beef).
Nantwich Cheese Fair	November 6 (Cheese).
Chester Cheese Fair	November 12 (Cheese).
Whitchurch Cheese Fair.	November 18 and 19 (Cheese).

The Popularity of National Mark Produce.—The following is an extract from the notes of the Secretary of the Retail Fruiterers' & Florists' Association, Ltd., published in the *Fruit, Flower and Vegetable Trades' Journal* of September 20, 1930 :—

> Although I have always been convinced that when the National Mark scheme has been more firmly established it would find favour in the eyes of the public, I must express astonishment at the hold it already has amongst consumers in many districts.
>
> In the course of a number of interviews with retailers I have



One of the winning displays in the window dressing competition, held in connexion with the National Mark Week at Bradford (Sept. 24–Oct. 4).

PUBLICITY FOR NATIONAL MARK PRODUCE

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Publicity for National Mark Produce: advertising on London omnibuses.

gathered that in the more residential districts, chiefly the newly-developed estates, considerable interest has been shown in the scheme. Many retailers reported that they had experienced a consistent demand for National Mark cucumbers and tomatoes, and apples and pears in season, whilst strawberries had also been keenly sought, but great difficulty had been found in obtaining sufficient supplies on the markets.

Although of recent birth, the National Mark canned fruit scheme seems to have gained considerable ground. Indeed, in one particular shop where considerable stocks of a certain brand were held, part of which bore National Mark labels, and part devoid of the emblem, the trader asserted that the public regarded the cans without labels with suspicion, and showed a marked preference for those cans with the National Mark attached.

Recipe for Bread made from National Mark Flour.*—The following instructions for baking home-made, all-English bread have been supplied by the Director of the National Bakery School, London :—

PLAIN LOAF

3½ lb. of "ALL-ENGLISH YEOMAN" Flour.
1 oz. Salt. *1 oz. Yeast (Distillers' compressed).*
1 oz. Lard.
1½ pints of water about 104° Fahr.

Take two basins and in each place 1 gill of the water at 104° Fahr. In one, dissolve the salt, and in the other break down the yeast. Now place the flour, into which the lard has been rubbed, in a bowl of suitable size and hollow it out in the centre. Into this hollow place 1 pint of the water together with the liquor from the basins. Mix together the flour and water by lifting them until all the flour is wetted. Then knead the mass until a clear piece of dough is obtained. In the case of some flours, it may be necessary, at this stage, to add anything up to an extra half gill of water at the same temperature, in order to incorporate all the dry flour in the dough. This however, is generally unnecessary.

The finished dough should be of a nice, medium consistency, and the temperature of it should be 82° Fahr. The dough should now be covered with a cloth and set in a warm place free from draughts. If the fireside is used, special care will be needed to prevent draughts.

At the end of 1 hour, place the dough on the table and knock it together thoroughly. Replace it in the basin and leave it for 1½ hours, at the end of which time it should be scaled off at 2 lb. 4 oz. for a 2-lb. loaf, or 1 lb. 3 oz. for a 1-lb size. After the loaf has been rounded and shaped, place in a greased tin and leave it to rise in a warm place for 45 minutes. At the end of this time, bake in a hot oven, for from 45 to 60 minutes, according to the temperature. The best results will be obtained with an oven temperature of 460° Fahr.

MILK LOAF

In making a milk Loaf, the above recipe should be followed, except that fresh milk should be used instead of water.

N.B.—It is sometimes the custom to add sugar, but this is not necessary. In milk bread, ½ oz. could be used.

* Copies of a leaflet (Marketing Leaflet 12d) containing this recipe may be obtained, post free, on application to the Ministry.

Marketing of Cheese in England and Wales.—The dairy industry is one of the most important sections of home agriculture, and in these days, when the production of milk greatly exceeds the needs of the liquid-milk market, a prosperous cheese industry is of vital importance to all dairy farmers, whether they themselves produce cheese or not. In view, therefore, of the important part played by efficient marketing in successful agricultural production, the latest addition to the Ministry's Economic Series of Reports (the Orange Books)* will be welcomed by all concerned. This Report is based on a comprehensive investigation of the methods of marketing cheese in this and other countries, which has been carried out by the Ministry with the aid of funds provided by the Empire Marketing Board.

The Report draws attention to the fact that 75 per cent. of the cheese supplies of this country are imported. It also indicates that, of home-produced supplies, about 75 per cent. is made on farms. In view of these facts, one of the most important conclusions arrived at is that British farm-made cheese, though in many cases greatly superior in quality to the imported product (largely factory-made), lacks, on the whole, the uniformity which is characteristic of much of the cheese supplied by our overseas competitors ; while the position that the factory industry at present occupies as virtually subsidiary to the liquid-milk distributive trade makes it difficult for English factories to turn out consistently a product of quality even equal to that of imported Cheddar.

The Report emphasizes the importance of the cheese-grading schemes in operation in a number of exporting countries—several being described in detail—in securing the degree of standardization which, together with cheapness, is largely responsible for the capture of the market in the main consuming centres by the imported product. With the object of enabling the buyer to obtain supplies of home-produced cheese of reliable quality and, it is hoped, stimulating a higher level of production, the application of the National Mark to both farm and factory-made cheese is suggested, and a proposed solution of the none-too-easy technical problem of applying the Mark is put forward. The essential features of the proposed scheme are the application by producers of a mark guaranteeing fat-content and identifying the maker,

* *Report on the Marketing of Dairy Produce in England and Wales, Part I—Cheese.* Ministry of Agriculture and Fisheries, Economic Series No. 22. Published by H.M. Stationery Office. Price 6d. net. (Post free, 9*d*.)

and the subsequent application, just previous to the sale of the cheese to the retailer, of the National Mark to cheese that already bears the "producer's guarantee mark" and attains to a required standard of excellence in respect of quality as a whole. The performance of the operation in two stages is made necessary by the change in quality to which cheese is subject during the period of storage.

As the Report points out, the operation of such a standardization scheme would render almost inevitable the organization of the large numbers of cheese-makers in this country, on a variety basis, for the purpose of controlling the issue and application of cheese marks, on lines similar to those followed in the Netherlands system of cheese quality control. The germs of such an organization exist in the two English cheese-makers' federations—The Cheshire Cheese Federation and the English Cheddar Cheesemakers' Federation. Such control-organizations might eventually carry out additional functions, such as publicity, for the particular variety with which they may be concerned. Examples indicating what is being accomplished by cheese-makers' organizations abroad are quoted in the Report.

The future of the cheese industry in this country is difficult to forecast. The Report draws attention to the fact that farm-made cheese to a large extent supplies a specialist market, the demand of the masses of the population for a low-priced article being more easily met by factory cheese, which lends itself to mass production and "routine marketing." The Report foresees that, if the increase in milk production continues, there is the possibility of the extension of single-purpose factory cheese-making of the type which had commenced to develop in this country in the latter half of last century in response to the influx of imported factory cheese, but the growth of which was checked by the expansion of the fluid milk market. The advantages of the single-purpose factory lie not only in the higher quality of the product, but also in the more efficient utilization of the by-product—whey. It is certain, however, that the organization of the cheese industry in the future will not be solely determined by the needs of the industry itself. As the Report concludes, "the bearing of the cheese industry on the dairy industry as a whole —its function as a balancer of supply and demand in the fluid milk market—connects it with still wider problems which again depend for solution on the creation of some comprehensive organization of milk producers generally."

NOVEMBER ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,
Director of Agriculture for West Sussex.

In the Fields.—*Sowing of wheat,* especially on the colder types of soils, if not already done, should be completed as early as possible ; such soils give few opportunities later in the season or early enough in spring to ensure satisfactory results. Soils of a lighter character and at a low elevation can be sown with wheat much later and still give a fair chance of success. In the southern counties a good deal of wheat is sown after the removal of mangolds or sugar-beet, and a good practice is to plough and furrow-press the land, sow the wheat and cover in with the harrows all on the same day. The large farm with multiple teams has a considerable advantage over the small one-team farm for work of this nature. Little Joss wheat has a good reputation for late sowing, and owing to the lateness of the season the quantity of seed should be more liberal.

The lifting of mangolds should be completed as early as possible, and the labour released from this work can be diverted to other seasonable work.

Hedges.—The maintenance of the hedges can now be attended to. Live fences have many advantages and do much to beautify the landscape. They are, however, expensive to maintain, and if allowed to get out of order become useless as a fence and not infrequently become a harbour for vermin. Hedges require attention at least once a year ; neglect means deterioration and increased expenditure at a later period if the fence is to remain useful. On reasonably well-cultivated arable land the hedges do get annual attention, but on pasture land it is too frequent to find accumulations of neglect, and thorns and brambles spreading from the fence and encroaching on the fields.

Ditches.—No less important is the maintenance of ditches. Drainage is the foundation of all successful cultivation both on arable and grass land. A survey of any agricultural district will indicate the immense amount of thought, skill and labour which has been expended in days gone by in laying out fields, planting hedges and cutting ditches. It is seldom that these can be much improved upon from the point of view of efficiency, though in many cases the fields are too small for economic large-scale cultivation. Neglect to maintain ditches in an efficient state leads to gradual deterioration of the land, a condition that is not rapidly rectified when the condition of the ditch is restored to an efficient state. Another feature

of neglected ditches that take the water from pipe drains is the silting over of the outlets. In few cases are the drains properly charted, and it is a real grievance with many a farmer who is taking over a new farm that there is nothing to indicate where the outlets are, or even whether the land is pipe-drained or not. It is not uncommon for farmers to continue making fresh discoveries in this direction many years after their occupation of a farm commenced. Very few ditches have been made unnecessarily, and there is every reason for keeping them in order and now is a good time to do the work.

With the Stock.—This month is the beginning of a severe and trying period for live stock of all kinds. The days are short and the weather cold and windy. The remnant of the autumn grass may tempt farmers to rely too much on what is now rather indifferent food for other than purely maintenance purposes. Where cattle are wintered out the situation should be of a sheltered character and the ground reasonably dry. A fair range is better than a too-confined space, but where small fields only are available the stock should be frequently changed round. Supplementary feeding may vary from a supply of hay or straw to a fairly complete ration with roots and cakes or meals. The amount and kind of food will vary very much with the class of cattle and the circumstances, but the method of giving the supplementary food can make a difference to its usefulness. A very practical and shrewd farmer who makes a success of his business, but does not write notes, considers that his success in outwintering cattle is due to giving the supplementary food regularly at the same time each day, and that time always early in the day, so that the cattle will not waste time waiting for the arrival of the food ; and when it was finished they had time to range, and select for themselves a suitable sheltered spot to spend the night. Grass sheep with adequate scope have less need for supplementary food than cattle ; indeed, the hardy mountain breeds on the poorest of fare seldom get supplementary food except during a heavy or protracted snowstorm. The same sheep under lowland conditions and in more or less confined situations will require supplementary food according to the extent of the limitation of their grazing. Now that grass sheep are increasing on the lowland areas, in many cases in the hands of men who are not used to them, it should be noted that grass sheep require some attention and that in shepherding grass sheep there is an art no less important than with folded sheep. There is some difference

of opinion as to whether the grazing should be in fields and the sheep changed round frequently or over the entire available range at one time. The former is preferred by many, but a good number are very successful with the latter method. Where the one-range method is adopted care should be taken that the whole range is more or less used.

The dairy cow now comes under full winter conditions. Feeding and management are more completely under control in winter than during summer. The main variable factor is the quality of the bulky foods such as hay and straw. Most farmers recognize the value of good fodder, but the actual extent of the damage that can be done by inferior material is not always appreciated. The amount of good hay that can be used is considerable, but where inferior hay is used it should be limited in amount and a more bulky concentrated ration given. The general management of the dairy cow is no less important than its food.

In very many cases, especially where the milk has to be delivered twice a day, the intervals between the milkings are very uneven. The nearer in equality the intervals are, the better the results, whether the total number of milkings is two or three per day. Not infrequently the intervals may be something like 9 hours between the morning and afternoon milkings and 15 hours between the afternoon and morning. In such circumstances, the morning's milk is larger in quantity but poorer in quality than the afternoon milk, but the quantity is not proportionately greater having regard to the number of hours since the previous milking. Milking at intervals of twelve hours would be an ideal, and was at one time a regular feature, especially on cheese-making farms. Ideals are not always economic possibilities, but it would be of interest to know exactly how close to uniform the intervals could be made economic at present cost of labour. "Three times milking" requires more labour, and the advantage over two milkings where the intervals are uneven is considerable, but except for really heavy-milking cows it is doubtful how far it would be justified over twice milking at even intervals. Uneven milking intervals have another disadvantage in that the bulk of the feeding is given also in the shorter interval, although the first and last feed respectively may be given before the morning milking and after the evening milking. Cows are fortunately somewhat adaptable in their feeding requirements as regards the number of times they are fed. Super cows which require large amounts of concentrated food to meet their daily requirements would need to have it distributed over a greater length of time than is necessary for the average cow. Whatever the number of times of feeding or milking may be it is most important to feed with strict regularity and to adhere generally to the use of concentrates followed by roots and subsequently by bulky fodder. Under such a system the cow would ration herself in bulky fodder and if the quantity given is readily cleared up within twenty minutes of feeding there should be no need to worry.

It should not be necessary to stress the importance of water in relation to the general health of the cow. Mangolds are a source of water, and where no roots are fed the need for water at more frequent intervals is imperative. A constant supply of water for the cow when tied up is a commendable ideal, but the milk yields obtainable under this arrangement, as compared with that of access to water twice daily, show less increase than might be expected.

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NOTES ON MANURES

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Choice of Phosphates.—In considering the improvement of poor grass land or the maintenance of herbage already in good condition phosphate will in most cases be the main requirement, and the question of the choice of suitable phosphatic fertilizers is sure to arise. It must be admitted at the outset that a complete answer to this question for all cases is not at present available, for the range of soil and climatic conditions to be explored is very wide, while modifications are being made in the nature of phosphatic fertilizers and new forms are from time to time being introduced.

The points of difference between phosphatic manures fall under the following heads :—

(1) Availability or rapidity of action, in which superphosphate and basic slags of high citric solubility usually take the lead.

(2) Provision of lime in quantities which, although small when judged by the ordinary standards of liming, are none the less appreciable. Basic slags are the best-known in this respect, and on an equal phosphate basis the low-grade slags furnish more lime than the high grade.

(3) Unit cost, in which the finely-ground mineral phosphates work out at the most favourable rates.

For general purposes basic slag maintains its place in the esteem of grassland farmers. The greater part of the home-produced article is of the same degree of solubility as the pre-war Bessemer slag which was used in the early experiments at Cockle Park and elsewhere, although appreciably lower in phosphate content (9–16 instead of 18 per cent. phosphoric acid). When dressings are adjusted to compensate for the change in grade, the same results may be expected from English high-soluble slags as from high-grade Bessemer slag, of which a relatively small amount is still imported from the Continent. Basic slags made with fluorspar, and showing a lower degree of citric solubility than the above, have been tested against the other types at many centres and have on the whole been slower to act, although in most cases a pronounced benefit has followed their use. More recently a type of low-soluble slag has been introduced to which the above findings may not necessarily apply, and this is at present being compared with high-soluble open-hearth slag at a number of centres in a new series of experiments. Farmers in the neighbourhood of works producing low-soluble slag can obtain this material at cheaper unit rates than are asked for the high-soluble type. We may say, therefore, that for most typical grassland soils and districts basic slag will be a safe choice as a phosphatic manure, and that, where it is important to secure an effect in the first season, a type which carries the guarantee of approximately 80 per cent. solubility in citric acid is to be preferred.

Superphosphate has in the past been somewhat overshadowed by basic slag as a source of phosphate for grassland improvement, and where the latter is known to act rapidly and well there is no reason to employ the somewhat more expensive water-soluble phosphate. Nevertheless, in dry situations and on calcareous soils superphosphate is quite in place, and its value is well-known to farmers in such regions. Further, it has the advantage in speed of action, and if application has been delayed until early spring it has been observed to affect the following hay crop rather more certainly than basic slags. With a highly soluble manure like superphosphate there is something to be said for the practice of giving little and often rather than a large initial application to last for a period of years.

Evidence is still accumulating with regard to the conditions which favour the use of ground rock phosphate and its performance in comparison with other sources of phosphoric acid. The opinion is that on the whole the effect of ground rock

phosphate is slower to appear than that of high-soluble basic slags. This is particularly so on the drier soils and in districts of low rainfall. Many observers report that the action begins to be marked in the year following application rather than in the first season. Moist conditions, a pronounced need for phosphate, a long, growing season, and a fine degree of grinding all seem to be helpful to its action. Very fine grindings of North African phosphate are now available. A common grade is the same as that of basic slag, *i.e.*, 80 per cent. through the 100-mesh sieve, while 85 per cent. through the standard sieve is readily obtainable. A further grinding furnishes a material at least 90 per cent. of which passes the 100-mesh sieve, while in some cases 90 per cent. is guaranteed to pass a sieve having 120 meshes per linear inch.

Bone phosphate has a considerable popularity for pasture improvement among farmers in certain districts, as, for example, in Cheshire and Shropshire. At present steamed bone-flour, which is the most suitable form for rapid utilization, is rather cheaper than usual and approaches superphosphate and high-grade slags in unit price. A mixture of superphosphate and steamed bone-flour is a popular dressing for pastures on calcareous soils.

In applying any form of phosphatic fertilizer, and in particular the less soluble forms, to grass land, the condition of the surface is important. The manure must find access to the soil before any benefit can be secured. Hence, growth should be grazed down, coarse patches mowed back, and any surface mat opened up by heavy harrowing. This surface preparation is in itself beneficial as it favours the development of the finer herbage, and this is further stimulated by the manure applied.

Grazing Experiment.—One of the striking results of the Cockle Park experiments in which the effects of manures on pasture are measured by the live-weight increase of the grazing stock is the much better utilization of the herbage by cattle and sheep together than by grazing with sheep alone. The live-weight gains over a period of years were approximately twice as great under the first system as under the second. Most of the grazing experiments so far reported have been carried out with sheep alone. A report of the mixed grazing trial,* carried out at Shoby by the Leicestershire Agricultural Education Committee, as part of the Research scheme of the Royal Agricultural Society, is therefore of considerable interest.

* T. Hacking, *Jour. Roy. Agric. Soc.*, Vol. 90, 1929.

The soil is Boulder Clay at 400 ft. elevation, and was taken over in poor and badly-grazed condition. Five plots, each of about 10 acres, were put down in 1923, and, after a preliminary year devoted to a uniformity trial, various phosphatic manures were applied and mixed grazing was continued for six seasons. Basic slag (30 per cent. phosphate) applied at 13 cwt. per acre was the most successful treatment, and there appeared to be a slight advantage in giving this amount in two dressings of 6½ cwt. three years apart rather than in applying the whole as a large initial dressing. Finely-ground North African phosphate applied at one dressing of 6¾ cwt. per acre was less effective than basic slag in these experiments, while the feeding of cotton cake on plots receiving half the standard dressing of slag gave no cash gain above that produced by the full dressing of slag alone. It was observed that systematic grazing and surface cultivation considerably improved the herbage quite apart from manuring, as shown by the appearance of the unmanured plots.

Fertilizers and Bushel Weight.—Some interesting points in connexion with the effect of manurial treatment on the quality of crops come out on examination of the bushel weight of grain in relation to manures applied. The general view is that potassic fertilizers help the movement of starch to the grain, and, since a well-filled grain is usually associated with a good bushel weight, the use of potash on soils deficient in this constituent might be expected to increase the bushel weight of the corn. Samples from a number of field experiments carried out in Germany have recently been examined from this standpoint and gave the following results when expressed in English units :—

Crop	*No. of expts.*	*Bushel Weight, lb.* *Without Potash*	*With Potash*
Wheat	5	57·4	60·3
Barley	7	51·2	52·0
Oats	26	35·9	39·8
Rye	10	53·3	55·8

In every case the bushel weight was increased by the inclusion of potash in the manure, oats and wheat being affected most and barley least. It was noted in these experiments that in some cases where the yield was not increased by the addition of potash nevertheless the bushel weight of the grain was raised.

The classical fields at Rothamsted and Woburn afford data along the same lines. The bushel weight of barley seems to

be little influenced either by potassic or the other standard manures. Thus, comparing the bushel weight of the grain from 10 plots receiving no potash with a corresponding series getting potash on Hoosfield, Rothamsted, we have :—

	Mean Bushel Weight, lb. *Without Potash*	*With Potash*
First 20 years of experiment	53·4	53·7
Last 20 years of experiment	52·4	52·6

The most marked effect was produced by potash when sulphate of ammonia was the source of nitrogen, the bushel weight being raised from 51·9 lb. to 52·9 lb. over the last 20-year period. At Woburn the only direct comparison is when sulphate of potash has been added to nitrate of soda, the corresponding bushel weights being 49·8 lb. and 50·5 lb. over the 20 years 1907-26.

Figures affording a direct comparison of the effect of sulphate of potash on wheat over a long period are as follows :—

	Bushel Weight, lb. *Without Potash*	*With Potash*
Rothamsted (50 years), Sulphate of Ammonia + Superphosphate	58·0	60·3
Woburn (20 years), Nitrate of Soda	57·9	58·8

The early experiments on oats at Rothamsted bring out only the effect of minerals as a whole and not potash individually. Over five seasons, two treatments showed a mean bushel weight of 34·8 lb. without minerals and 36 lb. with minerals. It is significant that where the biggest yield-increase for potash is obtained (approximately 11 bushels of wheat per acre) there also is the largest increase in bushel weight, 2·3 lb. per bushel. Where barley yields 4½ bushels more grain per acre at Woburn following potash manuring the bushel weight is also appreciably increased. The effectiveness of fertilizers is commonly regarded from the standpoint of crop increase, and this is their most important action. Nevertheless, with the bigger crop, there are usually associated secondary effects such as the above, which although small in themselves are well worthy of notice.

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PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended October 8				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) .. *	9 7*d*	9 7*d*	9 7*d*	9 7*d*	12 1
Nitro-chalk (N. 15½%) .. *	9 7*d*	9 7*d*	9 7*d*	9 7*d*	12 1
Sulphate of ammonia :— Neutral (N. 20·6%) .. *	9 1*d*	9 1*d*	9 1*d*	9 1*d*	8 2
Calcium cyanamide (N. 20·6%) *	8 7*e*	8 7*e*	8 7*e*	8 7*e*	8 1
Kainit (Pot. 14%) .. §	3 6	2 19	2 17	3 0	4 3
Potash salts (Pot. 30%) .. §	5 3	4 18	4 17	4 14	3 2
,, (Pot. 20%) .. §	3 15	3 9	3 6	3 5	3 5
Muriate of potash (Pot. 50%) §	9 10	9 3	8 16	8 19	3 7
Sulphate,, ,, (Pot. 48%) §	11 11	11 6	10 17	10 16	4 6
Basic Slag (P.A. 15¾%)‖ .. §	2 13*c*	2 3*c*	..	2 9*c*	3 1
,, (P.A. 14%)‖ .. §	2 7*c*	1 16*c*	1 16*c*	2 3*c*	3 2
,, (P.A. 11%)‖ .. §	..	1 9*c*	1 9*c*	..	..
Ground rock phosphate (P.A. 26-27½%)‖ .. .. .. §	2 2*a*	2 10*a*	2 5*a*	2 7*a*	1 9
Superphosphate (S.P.A.16%) §	3 11	..	3 9	3 6	4 2
,, (S.P.A.13¾%) §	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3¾%, P.A.20¼%) §	8 15	8 10	8 7	6 15	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%) .. .. §	5 17*b*	5 15*f*	5 15	4 7	..

Abbreviations: N.=Nitrogen; P.A.=Phosphoric Acid; S.P.A.=Soluble Phosphoric Acid; Pot.=Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 80% through standard sieve. *a* Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

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NOTES ON FEEDING STUFFS

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Dry Cows.—During recent years much has been said about the feeding of dry cows; it has been urged very strongly that high feeding right up to calving pays for itself time and again by the increased yields that are obtained in the following lactations. There is surprisingly little in the way of experimental evidence to support this, but most farmers who have tried it have considered it well worth while, so that it is probably true. It is not proposed here to go into the question of how much cake should be fed or of the best foods to use, but rather to try to indicate some of the physiological processes that are at work, and to show the logical basis for the newer methods of feeding dry cows, together with their limitations. Rule of thumb is all very well, but appreciation of the underlying factors gives intelligence a chance, and points the way to correct variations of procedure for individual cases.

Some cows go dry before they are intended to, and others keep on milking despite efforts to stop them, so that there is great variation in the length of time cows are dry previous to calving. Most farmers, if questioned on the subject, would express the opinion that it pays to give a cow a rest of 6 weeks or 2 months, and on the average that is just about what is allowed. The average length in the east of this country is just about 8 weeks, whilst in the north-west it is longer—about 11 weeks. Averages, however, though useful up to a point, only tell a part of the story; though the average is 8 weeks in the eastern counties some cows are not dry at all, and others at the opposite extreme have a rest of something like 6 months. Nearly 20 per cent. of the cows have periods of rest of less than 3 weeks, and these would suffer in their next lactation to the extent of over 10 per cent, say 70 gallons of milk; in the last 4 or 5 weeks of the previous lactation, when they ought to have been dry, they would give an average yield of at most 45 gallons, so that the loss must be round about 25 gallons each year: this loss occurs with every fifth cow in the eastern counties, and in the aggregate it must amount to a colossal volume of milk. A longer rest than 8 weeks is wasteful of time, and leads to progressively larger losses as it is increased; nevertheless nearly one-third of the cows in the east of England (and many more in the west) are dry for more than 10 weeks,

indicating a further great loss of milk at this end of the scale.

These considerations show that there is plenty of room for improvement; the best length of rest is between 6 and 8 weeks, and this is realized by farmers, but, though the average is all right, less than 20 per cent. fall within this range. There are undoubtedly cases which might advisedly fall outside the 6 to 8 weeks' range, but in practice it is usually the wrong ones that do so, and consequently it should be more widely appreciated what the physiological processes are that occur when a cow is dry.

The most obvious occurrence during the dry period is that the cow puts on flesh. Her life is rather an uneven one as regards the balance between food intake and expenditure; for a certain period after calving, when her yield is at its highest, she is living beyond her income and loses weight. As the yield drops she comes to an even balance, and subsequently her food is more than sufficient for her yield, and storage of food materials in her body takes place. When the balance actually changes over is, of course, determined by the rate of yield and the appetite (assuming her to be fed correctly), and fluctuates widely from cow to cow. With many cows the appetite will allow very little over and above the needs for the milk at any time during the lactation, and consequently storage can only occur when the cow is dry. In all cases there are better chances for storage when the cow is not milking, and the reserves accumulated will be very useful to fall back upon at the flush of the next milking period. That storage itself, as distinct from the rest from milking activity, has a beneficial effect on the next lactation yield has been shown by American work, where the planes of nutrition of two lots of cows were kept at the opposite extremes, and high feeding before calving was found to raise the yield, irrespective of the length of time dry. In passing, it is striking to notice that this work (done some 20 years ago) is still the only truly experimental justification for the "steaming up" system.

It might be expected that storage of nutrients against the drain at the time of maximum flow in the next lactation would show itself by putting that maximum up, but this is not the case. The highest point reached by a cow is determined by other factors, and the actual size of the glands (*i.e.*, the udder less the fat and connective tissue it contains) is probably of great importance in this connexion; consequently food storage during the dry period is more helpful in the later stages of the next lactation, and makes the production more uniform over

that period by staving off the fall. At the beginning of a lactation a good dairy cow will produce milk under practically any conditions. In another American investigation a very "milky" cow was kept on a bare maintenance ration for a month at the flush of her lactation, and despite the great shortage of food her yield only fell by 1 lb. from the beginning to the end of the month, though on its completion she was so weak that she could not stand. It is improbable that a more beefy animal would give such a startling result, but it serves to show that food material is not necessarily a decisive limiting factor in early lactation; it is rather that, after the initial stimulus is weakening, it becomes important as a means of keeping up the production.

High feeding after calving can do rather more than stave off the fall, as it has been shown to lead the cow to higher levels than she would otherwise have reached, but storage before calving has comparatively little effect in this way. There remains any amount of scope for further inquiry into this subject of food storage during the dry period; we have only the haziest ideas as to the physiological processes involved, and of the chemical reactions that are carried out. We have no idea of what wastage there is in converting food materials first into body substance, and at a later date converting this into milk constituents; nor of the effect on the fat-percentage of the milk thus subsidized by body reserves; nor as to whether the raising of the condition of the cow affects her resistance to disease.

Storage is an important occurrence during the time the cow is dry, but it does not account for the whole of the benefits of a rest; there is still a part of the effect left over for which the explanation must be sought in the changes occurring in the gland as a result of the fact that the cow is pregnant. Whilst the cow is carrying a calf her udder is being prepared for the production of milk. In the first pregnancy of a heifer this can be easily seen, and, though not so noticeable, similar changes occur during later pregnancies. The actual cells of the gland are in some way reconditioned. Though we have some knowledge of the secretions which cause this we have practically none as to the exact procedure, but what apparently happens is that many (possibly all) of the cells are (as it were) closed for repairs. This building up for the next lactation is a process of the opposite nature to actual secretion, so that milk yield is affected while it is going on. The effect can be detected by studying the yield of pregnant cows; it is found that it starts

immediately after service, but has only a very slight influence in reducing the yield for the first half of pregnancy. At this point, however (20th week of pregnancy), there is a sudden change, and the yield falls away rapidly. As in all cases with cows there is great variation in behaviour from one individual to another, but these tendencies can be seen in all. It seems only reasonable to assign the extra bit of the effect of the dry period, not accounted for by storage, to this process; it is probably hampered if the milk flow is kept going all the time, and a certain minimum period (and the indications are that this minimum period is about 6 weeks) of rest from milking, so that it can go forward unchecked, is necessary for its full completion.

Thus the effect of giving a cow a rest between milking periods is a double one: it allows her to store up food, and gives her gland a chance to become fully efficient. The former is a slow and continuing process, and from this point of view the longer the rest the better for the cow's next lactation yield. The latter can be accomplished in a relatively short time, but cannot be effectively completed without a rest, however high the plane of feeding is. We thus understand why it is that absence of rest between lactations leads to serious depression of yield, and that, though the longer the rest the greater the storage, comparatively little gain is made by lengthening it beyond 6 weeks, and that after about 8 weeks the extra milk in the next lactation will be insufficient to make up for that lost in the previous one by drying the cow off so soon. This is shown to be the case by the statistical analysis of milk records, which enables the magnitude of the effects to be measured. A cow dry for only a week will have her next lactation yield reduced by 14 per cent., as compared with what she would do if dry for 6 weeks. The reductions for 2, 3, 4, and 5 weeks are, respectively, 9, 6, 3, and 1 per cent., whilst the gains for longer rests than 6 weeks are smaller and run something under 1 per cent. for every week. It therefore follows that there is an optimum length from the economic point of view; that this optimum is realized by farmers makes it all the more deplorable that such heavy losses are incurred by departure from it in the wrong cases. It is freely admitted that the true optimum is not quite the same for all cows, but a consideration of those cases where a deviation from it is desirable will have to be postponed.

DESCRIPTION	Price per qr.		Price per ton	Manurial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Protein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	7 2	0 11	6 11	72	1 10	0·98	9·6
Barley, British feeding ..	—	—	5 10	0 8	5 2	71	1 5	0·76	6·2
„ Danubian	16 6	400	4 12	0 8	4 4	71	1 2	0·62	6·2
„ Persian	16 0	„	4 10	0 8	4 2	71	1 2	0·62	6·2
„ Russian	16 3	„	4 12	0 8	4 4	71	1 2	0·62	6·2
„ Tunisian	19 6	„	5 10†	0 8	5 2	71	1 5	0·76	6·2
Oats, English, white	—	—	5 13	0 9	5 4	60	1 9	0·94	7·6
„ „ black and grey	—	—	5 13	0 9	5 4	60	1 9	0·94	7·6
„ Canadian mixed feed ..	13 9	320	4 17*	0 9	4 8	60	1 6	0·80	7·6
„ Argentine	13 9	„	4 17	0 9	4 8	60	1 6	0·80	7·6
„ Chilian	15 0	„	5 5	0 9	4 16	60	1 7	0·85	7·6
„ German	23 3	„	8 3	0 9	7 14	60	2 7	1·38	7·6
Maize, Argentine	24 6	480	5 15	0 9	5 6	81	1 4	0·71	6·8
„ South African	25 6	„	5 18	0 9	5 9	81	1 4	0·71	6·8
Beans, English Winter ..	—	—	6 15§	1 2	5 13	66	1 9	0·94	20
Peas, Japanese	—	—	18 10†	0 19	17 11	69	5 1	2·72	18
Dari	—	—	8 5	0 10	7 15	74	2 1	1·12	7·2
Milling offals—									
Bran, British..	—	—	4 2	0 19	3 3	42	1 6	0·80	10
„ broad	—	—	5 10	0 19	4 11	42	2 2	1·16	10
Middlings, fine, imported ..	—	—	5 15	0 15	5 0	69	1 5	0·76	12
„ coarse, British ..	—	—	5 2	0 15	4 7	58	1 6	0·80	11
Pollards, imported	—	—	4 15	0 19	3 16	60	1 3	0·67	11
Meal, barley	—	—	6 0	0 8	5 12	71	1 7	0·85	6·2
„ maize	—	—	7 10	0 9	7 1	81	1 9	0·94	6·8
„ „ South African ..	—	—	5 17	0 9	5 8	81	1 4	0·71	6·8
„ „ germ	—	—	5 15	0 13	5 2	85	1 2	0·62	10
„ locust bean	—	—	6 5	0 7	5 18	71	1 8	0·89	3·6
„ bean	—	—	10 0	1 2	8 18	66	2 8	1·43	20
„ fish	—	—	18 0	2 17	15 3	53	6 0	3·21	48
Maize, cooked flaked	—	—	8 0	0 9	7 11	83	1 10	0·98	8·6
„ gluten feed	—	—	6 15	0 17	5 18	76	1 7	0·85	19
Linseed cake, English, 12% oil	—	—	10 10	1 6	9 4	74	2 6	1·34	25
„ „ „ 9% „	—	—	9 15	1 6	8 9	74	2 3	1·20	25
„ „ „ 8% „	—	—	9 7	1 6	8 1	74	2 2	1.16	25
Soya bean cake, 5½% oil ..	—	—	8 2*	1 16	6 6	69	1 10	0·98	36
Cottonseed cake—									
„ „ English, 4½% oil	—	—	4 10	1 4	3 6	42	1 7	0·85	17
„ „ Egyptian, 4½% „	—	—	3 17	1 4	2 13	42	1 3	0·67	17
Decorticated cottonseed meal, 7% oil	—	—	9 10*	1 16	7 14	74	2 1	1 12	35
Ground-nut cake, 6-7% oil ..	—	—	6 5§	1 4	5 1	57	1 9	0.94	27
Decorticated ground-nut cake, 6-7% oil	—	—	7 12	1 16	5 16	73	1 7	0·85	41
Palm kernel cake, 4½-5½% „	—	—	6 0§	0 15	5 5	75	1 5	0·76	17
„ „ „ meal, 4½% „	—	—	6 10§	0 15	5 15	75	1 6	0.80	17
„ „ meal 1-2% oil ..	—	—	5 10§	0 16	4 14	71	1 4	0·71	17
Feeding treacle	—	—	5 15	0 8	5 7	51	2 1	1·12	2·7
Brewers' grains, dried ale ..	—	—	4 7	0 16	3 11	48	1 6	0·80	13
„ „ „ porter ..	—	—	4 0	0 16	3 4	48	1 4	0·71	13
Malt culms	—	—	6 0†	1 4	4 16	43	2 3	1·20	16
Dried sugar beet pulp ..	—	—	5 5	0 7	4 18	65	1 6	0·80	5·2

* At Bristol. † At Liverpool. § At Hull.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of September and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £7 per ton, then since its manurial value is 15s. per ton as shown above, the food value per ton is £6 5s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 1s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0·89d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 8s. 0d.; P_2O_5, 2s. 11d.; K_2O, 3s. 0d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6·2	4 16
Maize	81	6·8	5 16
Decorticated ground nut cake	73	41·0	7 12
" cotton cake	71	34·0	8 15

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·35 shillings, and per unit protein equivalent, 2·03 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

In accordance with the recommendation of this Committee, the "food values" given in the following table may be taken as applicable to the ensuing four months, December to March, inclusive, for the purposes of advisory schemes on the rationing of dairy cows.

FARM VALUES

CROPS	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Roots—			
Kohl Rabi	8	0·5	0 12
Mangolds	7	0·4	0 10
Potatoes	18	0·6	1 6
Swedes	7	0·7	0 11
Turnips	4	0·4	0 6
Green foods—			
Cabbage, drumhead	7	0·9	0 11
" open-leaved ..	9	1·5	0 15
Kale, marrow stem	9	1·3	0 15
Silage, vetch and oats ..	13	1·6	1 1
Hay—			
Clover hay	38	7·0	3 6
Lucerne hay	29	7·9	2 15
Meadow hay, poor	22	2·9	1 16
" " good ..	37	4·6	2 19
" " very good ..	48	7·8	4 1
Seeds hay	29	4·9	2 9
Straws—			
Barley straw	23	0·7	1 12
Bean straw	23	1·7	1 14
Oat straw	20	0·9	1 9
Wheat straw	13	0·1	0 18
Grains and seeds—			
Barley	71	6·2	5 8
Beans	66	20·0	6 10
Oats	60	7·6	4 16
Peas	69	18·0	6 10
Wheat	72	9·6	5 17

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, price 6d. net.

MISCELLANEOUS NOTES

The Control of Moles

A NOTE published in last month's issue of this JOURNAL (October, 1930, p. 646) gave some particulars of experiments conducted by the Department of Agriculture and Horticulture of the University of Bristol in the control of moles. That Department has issued a more detailed account of these experiments in a bulletin, "Mole Destruction Experiments," and readers interested may obtain copies gratis on application to the Agricultural Advisory Office, 22 Berkeley Square, Bristol.

* * * * * *

The Agricultural Index Number

PRICES of agricultural produce in September were on average 42 per cent. above those ruling in the base years 1911-13, as compared with 35 per cent. and 52 per cent., respectively, a month and a year earlier. The rise of 7 points from August was due primarily to increases in the prices of milk and potatoes.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	37
May	57	50	42	54	44	34
June	53	48	41	53	40	31
July	49	48	42	45	41	34
August	54	49	42	44	52	35
September	55	55	43	44	52	42
October	53	48	40	39	42	—
November	54	48	37	41	44	—
December	54	46	38	40	43	—

Grain.—Following the slight advance in wheat prices between July and August, a substantial reduction was recorded in the month under review, and the index number fell by 7 points to 3 per cent. below 1911-13, this being the first occasion since 1914 that the wheat index has been lower than the pre-war level. The marketing of new crop barley was accompanied by the customary advance in quotations, the September average being 1s. 11d. per cwt. higher on the month at 3 per cent. in excess of September of the base years.

Values for oats receded 2d. per cwt., but as the reduction was proportionately less than that recorded between August and September, 1911-13, the index number was one point higher at 12 per cent. below pre-war. As compared with a year ago, wheat was 2s. 7d. per cwt., and barley and oats 2s. per cwt. cheaper, the index figures being lower by 34, 24 and 29 points, respectively.

Live Stock.—Quotations for fat cattle were a little lower during the month under review, and the index number declined by 2 points to 35 per cent. above the 1911-13 level. Fat sheep were unchanged both in price and index number. In the case of fat pigs, the advance recorded in August was not maintained during September; quotations for second quality bacon pigs eased by about 9d. per score lb. and for porkers by about 4d., and the relative index figures were 8 and 6 points lower at 33 and 44 per cent. respectively above pre-war. Both dairy cows and store cattle were about 4s. per head cheaper on the month, and the index numbers declined by 4 and 3 points, respectively, to 31 and 27 per cent. in excess of 1911-13. Values for store sheep were rather higher at 69 per cent. above the base level. Store pigs, however, showed a decline and the index number was 5 points lower at 107 per cent. above pre-war.

Dairy and Poultry Produce.—Milk prices in most areas rose to winter levels during September, and the index figure was 42 points higher than in August at 100 per cent. above 1911–13. A year ago, the corresponding figure was 107 per cent. Butter, however, was slightly cheaper at 24 per cent. in excess of pre-war. Values for cheese moved upwards, but as the rise was proportionately less pronounced than that recorded in the base period, the index number declined by 6 points. Egg prices continued their seasonal advance, but the rise was rather below normal and the index number was 4 points lower at 36 per cent. in excess of 1911–13. At the corresponding period last year, eggs were 57 per cent. dearer than pre-war. The index for poultry during September fell by 3 points to 40 per cent. above the base level.

Other Commodities.—Quotations for potatoes were rather higher on the month at 51 per cent. above pre-war, a rise of 39 points as compared with September last year. Prices of clover hay fell by about 2s. 6d. per ton, while the meadow variety also was a trifle cheaper, and the combined index for both kinds of hay was 4 points lower at 11 per cent. above 1911–13. Fruit averaged 6 per cent. and vegetables 28 per cent.

more than in the base period. Values for wool were slightly reduced to 8 per cent. below pre-war.

Index numbers of different commodities during recent months and in September, 1928 and 1929, are shown below :—

Percentage increase as compared with the average prices ruling in the corresponding months of 1911-13.

Commodity	1928	1929	1930			
	Sept.	Sept.	June.	July.	Aug.	Sept.
Wheat	22	31	7	2	4	—3*
Barley	50	27	—4*	—12*	—12*	3
Oats..	33	17	—16*	—20*	—13*	—12*
Fat cattle	36	34	27	30	37	35
,, sheep	59	55	66	66	62	62
Bacon pigs	33	52	46	40	41	33
Pork ,, ...	32	55	52	49	50	44
Dairy cows..	34	35	29	32	35	31
Store cattle..	27	16	28	29	30	27
Store sheep..	66	63	65	78	66	69
Store pigs	28	83	101	100	112	107
Eggs	52	57	29	44	40	36
Poultry	42	45	57	47	43	40
Milk	65	107	55	58	58	100
Butter	54	52	24	31	33	24
Cheese	78	42	42	32	28	22
Potatoes	60	12	—40*	23	25	51
Hay	14	42	25	18	15	11
Wool	76	47	—1*	—4*	—5*	—8*

* Decrease.

* * * * * *

Fifteenth International Agricultural Congress, 1931.—The Fifteenth International Agricultural Congress will be held at Prague from June 5 to 8, 1931, under the patronage of the President of the Czecho-Slovak Republic. Subjects for discussion include agricultural instruction, agricultural propaganda, agricultural co-operation, rural economy, rural industries, animal and plant production, and the place of women in agriculture. Application for stand space and other information should be made to the General Secretary, Comité d'Organisation du XVe Congrès International d'Agriculture, 2, Rue Dlázdená, Prague.

* * * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on Tuesday, September 23, 1930, at 7 Whitehall Place, London, S.W. 1, the Right Hon. The Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying these decisions into effect.

Gloucestershire.—An Order to continue the operation of the existing minimum and overtime rates of wages from October 5, 1930, until

October 3, 1931. The minimum rates in the case of male workers of 21 years of age and over are: Head-carters, 36s. per week of 52½ hours in the week in which Christmas Day falls and 60 hours in any other week in winter; 34s. 6d. per week of 51 hours in the week in which Good Friday falls and 58 hours in any other week in summer. Under-carters, 34s. 6d. per week of 50¼ hours in the week in which Christmas Day falls and 57 hours in any other week in winter; 32s. 6d. per week of 48 hours in the week in which Good Friday falls and 54 hours in any other week in summer. Head-shepherds or head-stockmen, 36s. per week of 52½ hours in the weeks in which Christmas Day and Good Friday fall and 60 hours in any other week. Under-shepherds or under-stockmen, 34s. 6d. per week of 50¼ hours in the weeks on which Christmas Day and Good Friday fall and 57 hours in any other week. Other male workers, 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 hours in any other week in winter, 41 hours in the week in which Good Friday falls and 50 hours in any other week in summer. Overtime is payable in the case of all classes of male workers at 9d. per hour on weekdays and 11d. per hour on Sundays, Christmas Day and Good Friday. In the case of female workers the minimum rate is 5d. per hour for all time worked irrespective of age.

Lincolnshire (Holland).—An Order to come into operation on October 26, 1930 (*i.e.*, the day following that on which the existing rates are due to expire), and to continue in force until October 31, 1931, fixing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers. The minimum rates in the case of male workers of 21 years of age and over are: 33s. 6d. (instead of 35s. as at present) per week of 50 hours in summer and 48 hours in winter, with in addition in the case of cattlemen and shepherds 6s. per week, and in the case of horsemen 10s. per week to cover employment other than overtime employment in excess of these hours. In the case of shepherds certain payments have also to be made in respect of the lambing season. The Order also provides for reductions in the minimum rates for male workers of 17 and under 21 years of age. The overtime rates for male workers of 21 years of age and over are 9d. per hour, except on Saturdays when the rate is 10½d. per hour, and on Sundays when the rate is 1s. 1½d. per hour. In the case of female workers of 15 years of age and over the minimum rate is 6d. per hour for all time worked.

Shropshire.—An Order cancelling the existing minimum and overtime rates of wages as from December 20, 1930, and fixing fresh rates as from December 21, 1930. The minimum rate in the case of male workers of 21 years of age and over is 32s. 6d. per week of 44½ hours in the weeks in which Christmas Day and Good Friday fall, and 54 hours in any other week, with overtime at 9d. per hour, except for employment on Sundays on work other than the care of and attention to livestock when the rate is 10d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6d. per hour.

Pembroke and Cardigan.—An Order continuing the operation of the existing minimum and overtime rates of wages from October 1, 1930, until September 30, 1931. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 52 hours in winter and 54 hours in summer with overtime at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for a day of 8 hours with overtime at

6d. per hour on weekdays, 6½d. per hour for the first three hours of overtime on Sundays and 7½d. per hour for subsequent hours.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

* * * * * *

Enforcement of Minimum Rates of Wages.—During the month ending October 14, legal proceedings were instituted against 20 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

County	Court	Fines £	Fines s.	Fines d.	Costs £	Costs s.	Costs d.	Arrears of wages £	Arrears of wages s.	Arrears of wages d.	No. of workers involved
Buckingham	Chepping Wycombe	1	0	0	0	16	0	21	18	9	4
Cumberland .	Carlisle ..	1	0	0	2	7	0	10	7	0	1
Gloucester ..	Berkeley ..	4	0	0	2	0	0	26	11	3	3
,, ..	Chipping Sodbury		—		0	10	6	5	1	10	1
Lancaster ..	Lytham ..		—		3	3	0	11	10	3	2
Salop ..	Bishop's Castle		*		0	9	6	22	17	6	1
,, ..	Wellington ..	1	0	0	1	18	0	4	12	0	3
Yorks, N.R. .	Scorton ..		*		2	11	0	45	15	4	3
,, W.R.	Knaresborough	1	0	0		—		36	7	10	2
,, ,,	Rotherham .	10	0	0		—		33	0	0	2
,, ,,	,, .	10	0	0		—		100	0	0	2
,, ,,	,, .	0	5	0	0	4	0	1	2	9	1
Anglesey ..	Llangefni ..	1	0	0		—		11	10	0	2
Cardigan ..	Cardigan ..	3	0	0		—		19	0	8	2
Carmarthen .	Carmarthen .	1	0	0		—		2	2	0	1
Denbigh ..	Llangollen ..		—		0	9	0	3	2	3	1
Glamorgan ..	Barry ..	4	0	0		—		15	11	0	2
,, ..	Neath ..	5	0	0	4	4	0	5	0	0	1
,, ..	Swansea ..		—		5	5	0	15	0	0	3
Montgomery	Machynlleth		*		0	16	0	16	16	0	2
		£42	5	0	£24	13	0	£407	6	5	39

* Dismissed under Probation of Offenders Act.

* * * * * *

Foot-and-Mouth Disease.—A further outbreak was confirmed on September 28 at Bilsdale, Stokesley, Yorkshire (North Riding). The previous outbreak in that locality—referred to in the October issue of this JOURNAL—was confirmed on September 20. No further outbreaks having occurred in the Yorkshire (West Riding) or Surrey infected areas, or in the Yorkshire (North Riding) infected area since September 28, the restrictions in force in those areas were withdrawn on September 29 and October 14 and 19 respectively.

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APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND.

Cornwall: Mr. E. Beckley has been appointed Head Gardener and Lecturer at the Tamar Valley Experimental Station, *vice* Mr. C. E. Grainger.

Derbyshire: Mr. G. E. Limb, B.Sc., N.D.A., has been appointed District Agricultural Organizer, *vice* Mr. G. H. Bates, B.Sc.

Devonshire : Mr. J. E. F. Jenks, N.D.A., C.D.A., has been appointed District Lecturer in Agriculture, *vice* Mr. J. N. Sharrock, N.D.A., N.D.D.

Essex : Mr. R. J. Fleming, N.D.D., B.D.F.D., has been appointed Assistant Instructor in Dairying, *vice* Miss G. M. Woods, N.D.D., B.D.F.D.

Mr. R. N. Sadler, N.D.A., N.D.D., has been appointed District Agricultural Organizer and Lecturer in Dairy Husbandry.

Herefordshire : Mr. S. F. Siderfin has been appointed Manager of the County Egg-Laying Trials.

Isle of Ely : Mr. W. F. Cheal, N.D.A., D.I.C., has been appointed Horticultural Superintendent, *vice* Mr. W. G. Kent, N.D.H.

Kent : Mr. W. Corbett has been appointed Instructor in Glass-house Work and Market Gardening.

Mr. L. C. Turnill has been appointed Assistant Instructor in Poultry Keeping.

Norfolk : Mr. P. E. Cross* has been appointed Assistant Instructor in Horticulture.

Miss E. Turnbull has been appointed Manageress of the County Egg-Laying Trials.

Shropshire : Mr. W. E. Usher, B.Sc., has been appointed Agricultural Instructor, *vice* Mr. T. B. Evans, B.Sc.

Mr. A. H. Whyte has been appointed Horticultural Lecturer, *vice* Mr. R. Duncan.

Miss B. A. M. Chamberlin has been appointed Assistant Instructress in Poultry Keeping.

Miss B. Halford has been appointed Manageress of the County Egg-Laying Trials.

Sussex (West) : Miss K. Elliott, N.D.P., has been appointed Manageress of the County Egg-Laying Trials.

Wiltshire : Mr. W. Saint has been appointed Manager of the County Egg-Laying Trials, *vice* Mr. F. R. Wallbutton.

Yorkshire (Agricultural Department, University of Leeds) : Miss E. M. Crossley, N.D.D., has been appointed Assistant Instructress in Dairying, *vice* Miss M. L. Evelyn, N.D.D.

Mr. J. M. Mackay, B.Sc., A.I.C.E., has been appointed Assistant Lecturer in Agricultural Engineering, *vice* Mr. H. Preston, B.Sc., A.M.I.Struct.E.

Miss W. E. Jolly has been appointed Instructress in Rural Domestic Economy.

WALES.

Carmarthenshire : Miss P. M. Jones has been appointed Instructress in Rural Domestic Economy.

Glamorganshire : Mr. C. R. S. Gregory has been appointed Instructor in Horticulture.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES.

Studley College, Warwickshire.

Miss Bryan, B.Sc., has been appointed Lecturer in Botany and Chemistry, *vice* Miss M. Madge, B.Sc., Ph.D., resigned.

Miss M. Pringle, N.D.D., C.D.P., has been appointed Assistant-Instructress in Poultry Husbandry, *vice* Miss V. Dowse, N.D.A., resigned.

Miss K. F. Kaye, N.D.D., C.D.A., has been appointed Lecturer and Instructress in Agriculture.

* Wholly employed by the County Council, but only partially on agricultural education work.

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

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NOTES FOR THE MONTH

Grazing Problems

ONE of the most valuable qualities the farmer can possess day is adaptability ; and, in general, he has it in a very real though perhaps not readily recognized form. Farming is a slow business, and does not lend itself to sudden changes. There is the character of the soil as a iiting factor ; the farming tradition of the district built on centuries of experience ; and the adopted rotation of ›ps which fit in with one another and produce the most ›nomic return for the expenditure. There may be many ıer factors which operate against change, but notwith- ›nding them all, the careful observer to-day will find modi- ıations of farming practice going on gradually in almost ›ry part of the country ; and he will find that although › steps taken to reach something better are necessarily w, sound reason is usually on the side of the practising mer.

To take an example : temporary leys are recommended for › East Anglian farmer as a means of conserving labour d adding to the fertility of his soil. After due thought, he ›ponds by laying land down to lucerne, thus securing even ›ater soil enrichment and a higher degree of insurance ainst drought. The farmer is advised to adopt intensive tational grazing ; but he is not normally short of grass in mmer (*i.e.*, up to the limit of his capital in these times) and knows that in a drought, water, not fertilizer, is the deter- ning factor. He does not, therefore, too readily adopt › new system, but he quickly takes in that part of the ›son which gives him a lengthening of the grazing season both ends by the aid of artificial manures, and he remembers r use another part of the story which shows the excellent ›ect of nitrogen on Italian rye-grass in promoting early ring keep. The great thing, he is well aware, is to secure a pply of grass as long as possible through the winter, for he

knows that he must look to out-wintering more and more for reasons both of farming economy and of the health of stock. Usually, he has to pin his faith to a pasture left rough in autumn. One eaten down bare in autumn and grazed intermittently throughout the winter has little stock-carrying capacity in the "dead" season and starts growth late in spring. Where, however, it has been well grazed, is manured in the early autumn, and then left unstocked for a couple of months, it will usually produce a fair abundance of fresh, green keep at a time when succulent herbage is scarce. The farmer knows that it is impracticable to manure all his winter grass, and has to content himself with a judicious blend of various treatments—rough pasture, bare pasture manured early and saved for a month or two, and Italian rye-grass helped along by nitrogen for earliest spring keep. Closely related to this question of out-wintering is that of the provision of shelter. The more farseeing are giving increased attention to the planting up of shelter belts; that is, in cases where the cheaper home-made shelters will not meet requirements.

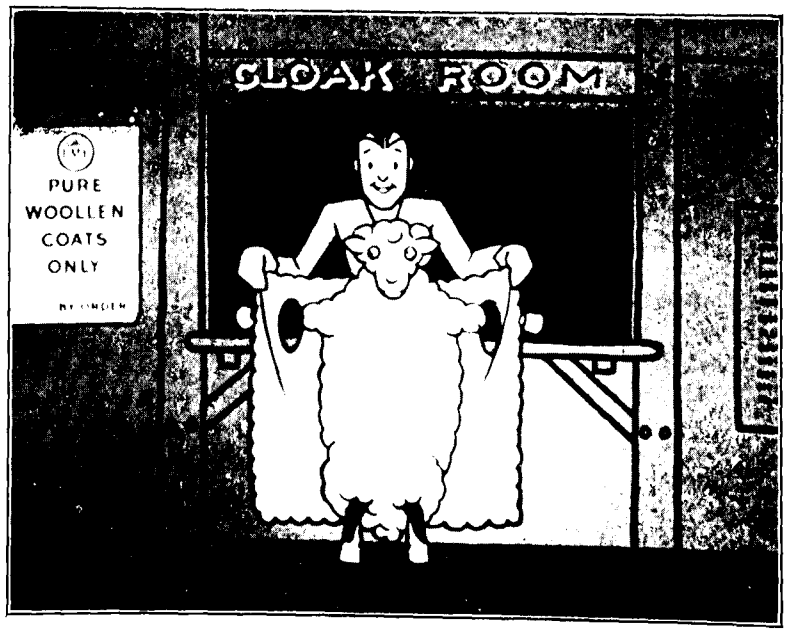
* * * * * *

The House that John Built

NOVELTY is the breath of life to publicity, and the opportunity for novel advertising offered by such a popular medium as the comic film cartoon is one that cannot be ignored in a progressive and up-to-date publicity policy. Why should not the world of corn, cabbages and cows be given all the antics of Mickey Mouse and his brethren, and sent round the theatres to declare the especial virtue of the produce of the English farm and farmyard? It is interesting to note that the Empire Marketing Board has produced a comic film cartoon as a means of advertising home produce.

The Board's film, "The House that John Built," takes full advantage of the licence which is allowed in the fairy-tale world of the cartoon. John is the British producer and the House that is built is England—the England of sheep and pigs and orchards and dairies and harvests—but the scarecrow chases off the marauding crow with a pitchfork; the sheep takes off her woollen garments as a comedian divests himself of a dozen waistcoats; the pigs stage a banquet to fatten themselves magnificently for market; the cow supplies a magical milking pail from space, and so on. The produce of the land comes to the shops of England in aeroplanes, balloons and parachutes.

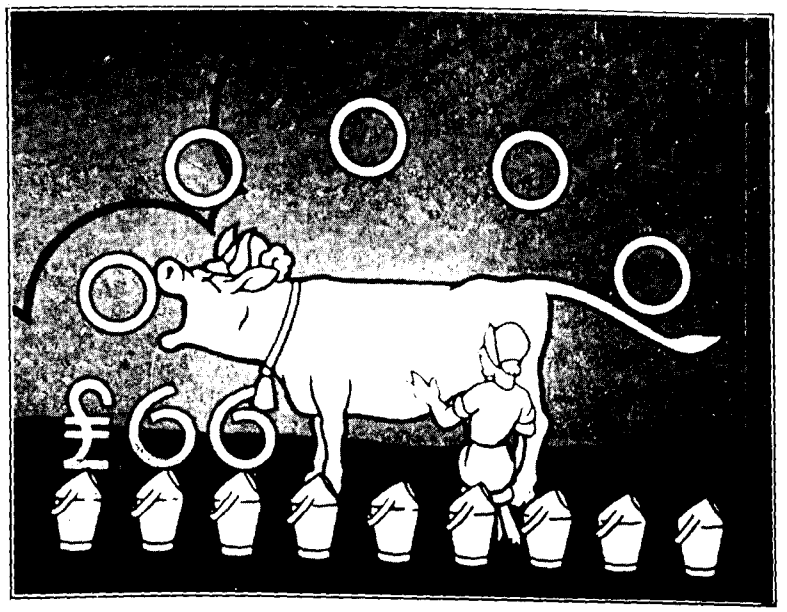
The scarecrow chases the marauding crow.



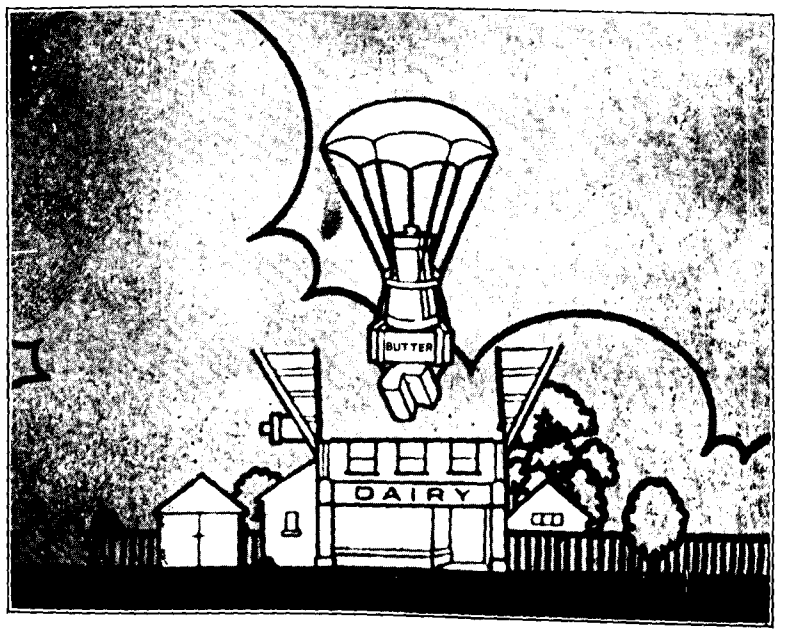
The sheep takes off her woollen garments.

"STILL" PICTURE INCIDENTS FROM THE FILM, "THE HOUSE THAT JOHN BUILT."

To face page 846.



The cow's magic milking pails.



The dairy produce arrives by parachute.

"Still" Picture Incidents from the Film, "The House that John Built."

The secret of the popularity of the cartoon film is the fact that it can be as fantastic as it pleases. Jumping over the moon becomes the very simplest and most obvious thing a self-respecting young cow can do. Given enough comic invention, the cow can become the really magnificent animal she is in the Mickey Mouse cartoons—a xylophone player, an orchestra conductor, a figure of tragedy pursued by maddened motor cars, or a ju-ju dancer in the jungle. The point for publicity is that, made alive in this way, she will sell her milk and butter and cheese the more cheerfully and effectively for it.

"The House that John Built" has already been shown by the Ministry at the Royal Agricultural Society's Show at Manchester this year, and at Leamington and Hereford in connexion with National Mark Weeks. It was shown by the Empire Marketing Board at the Imperial Fruit Show at Leicester, and is now included in the Board's library of films and will be used in the various types of non-commercial display in which the Board engages from time to time. Those who have an opportunity should not fail to see this entertaining and instructive film.

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Advisory Leaflets

A note on the Ministry's new series of Advisory Leaflets was published in the October, 1930, issue of this Journal, p. 650. The following leaflets in this series have been issued since last spring :—

No. 1. Tuberculosis in Poultry.
" 2. Destruction of Charlock.
" 3. Coltsfoot.
" 4. Sheep Maggot Fly.
" 5. Potato Scab.
" 6. Blackquarter, Quarter Ill or Black Leg.
" 7. Management of Bulls.
" 9. Insecticides and Fungicides.
" 10. Fruit Tree Red Spiders.
" 11. Winter Moths.
" 12. Mole Draining.
" 13. Apple Sawfly.
" 14. Sheep Nostril Fly.
" 15. "Husk" or "Hoose."
" 17. Swine Erysipelas.
" 18. Cabbage Root Fly.
" 20. "Blackhead" of Turkeys.

The Ministry is now able to supply free of charge up to four leaflets on any one subject, *e.g.*, fruit growing ; diseases of animals ; manures ; insect pests ; fungus diseases ; weeds ; etc., with a maximum of 20 leaflets in all. Above these limits,

leaflets will be charged for at the rate of ½d. each, or 6d. per dozen, post free. If groups of leaflets dealing with related subjects are required, the Sectional Volume of Collected Leaflets or the Bulletin dealing with the subject should be purchased. A list of the Ministry's leaflets and priced publications will be sent gratis and post free on request.

It is not very generally known that a scheme is in existence whereby persons who wish to receive the Ministry's leaflets as issued, without special application, may do so on payment of a nominal registration fee. Reference was made to the arrangement in the July, 1928, issue of this JOURNAL, p. 309, but the fees payable have since been reduced.

For convenience the leaflets are divided into four main groups dealing with the following subjects :—

I. Farm Live Stock (including Dairying, Feeding Stuffs, Pests and Diseases of Farm Animals).
II. Small Live Stock (Poultry, Rabbits, Bees, Goats).
III. Farm Crops (including Manures, Weeds, Pests and Diseases of Farm Crops).
IV. Garden Crops and Fruit Growing (including Manures, Weeds, Pests and Diseases of Garden Crops and Fruit Trees).

The annual registration fees now payable are as follows :—

To receive New *and* Revised Leaflets	*per annum*
1. Of any one or two groups	1s. 0d.
2. Of any three or of all four groups	1s. 6d.

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Dairy Instructors' Conference, 1930

THE Seventh Annual Conference of County and College Dairy Instructors and Instructresses in England and Wales, convened by the Ministry, was held on October 23 at the Civil Service Commission, Burlington Gardens, under the chairmanship of Mr. J. F. Blackshaw, O.B.E., the Ministry's Dairy Commissioner. In addition to county and college instructors and instructresses, there were present a number of county agricultural organizers and principals of agricultural colleges, the total attendance reaching 130. The Conference was opened by Earl De La Warr, Parliamentary Secretary to the Ministry.

Papers on the following subjects had been circulated before the date of the meeting :—

"Organized Milk Distribution by Producers," by Mr. F. N. Gingell, M.R.I.P.H., Manager, Harpenden Dairies, Ltd.

"Milk in Schools organized on a County Basis," by Mr. T. Hacking, M.Sc., Agricultural Organizer for Leicestershire.

"Courses of Instruction on Clean Milk for Health Visitors," by Mr. C. H. Westwater, M.A., B.Sc. (Agr.), Armstrong College, Newcastle-upon-Tyne.

"Some American Experiences," by Mr. R. Boutflour, M.Sc., Director of Dairy Husbandry, Harper Adams Agricultural College, Newport, Salop.

"A Travelling Dairy School in an Industrial Area," by Miss H. S. Wood, N.D.D., Instructress in Dairying, Nottinghamshire.

"Laboratory Control of Commercial Milk Supplies," by Mr. L. J. Walker, N.D.A., N.D.D., B.D.F.D., United Dairies (London), Ltd.

"Co-operative National Scheme for the Purchase and Sale of Milk," by Mr. G. Walworth, M.A., Dip. Agric. (Cantab.), Agricultural Organizer, Co-operative Union, Ltd.

"Some Cheese Problems," by Dr. A. T. R. Mattick, B.Sc., and Mr. J. G. Davis, M.Sc., National Institute for Research in Dairying, Reading.

Each paper was introduced at the meeting with a short address which was followed by open discussion.

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Poultry Instructors' Conference, 1930

THE Ninth Annual Conference of County and College Poultry Instructors was held on October 21 at the Civil Service Commission under the chairmanship of the Ministry's Poultry Commissioner, Mr. Percy A. Francis, O.B.E. Ninety-eight instructors, agricultural organizers, principals of colleges, and others were present.

Earl De La Warr, the Parliamentary Secretary to the Ministry, who opened the proceedings, spoke of the enormous strides made by the poultry industry during the last few years. Although the consumption of home-produced eggs had doubled, the importation of foreign eggs had not materially increased since 1913. There was ample scope for still greater home production, and the Ministry looked to poultry instructors to utilize the opportunities offered by personal contact with producers to capture more of the market at present held by imported supplies. Earl De La Warr also referred to the National Mark Scheme as part of the national effort for building up a demand for home produce, and to the Marketing Bill, which contained proposals for improving the marketing organization of the industry.

Professor R. T. Parkhurst, Director of the National Institute of Poultry Husbandry, contributed a paper on the possibilities of battery-brooding in this country. Mr. F. S. Dennis, Advisory Economist at Harper Adams Agricultural College, outlined a scheme for the collection of data on poultry costings. Mr. Tom Newman, of the Scientific Poultry Breeders' Association, spoke on intensive poultry keeping, and Mr. F. W. Bowers, formerly County Poultry Instructor for Essex, dealt with the development of day-old chick hatcheries. Mr. B. C. Brewer, Chief County Poultry Instructor for Somerset, and Mr. E. Russell, the Devon County Poultry Instructor, contributed papers on approved poultry breeding stations and the cockerel breeding scheme, both of which were referred to a select committee for the consideration of points of detail. All papers were followed by open discussion.

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THE following note has been communicated by Mr. J. M. Templeton, B.Sc., Principal of the Farm Institute, Sparsholt, near Winchester :—

Short Course for Cowmen

A member of the Hants Agricultural Education Committee made the suggestion that short courses of a week or less should be arranged for farm workers. This suggestion was acted upon and a short course for cowmen, of three days' duration, was arranged at the Farm Institute, Sparsholt. It was found that three days was as long as men in permanent employment could easily be away from their work, and although this period was considered too short to cover the ground satisfactorily, yet it was felt that good work could be done in the time.

The course for cowmen was planned (1) because of the very large dairying interest in the county, (2) because of the need to hold such a course before the busy, winter season began, and (3) because of the excellent equipment available at Sparsholt. The course was held from September 16-19, and the men resided in the hostel. A very satisfactory response was given, and 12 cowmen were enrolled. The fee for the course was 10s., and was in all cases paid by the employers. Most of the men were head cowmen, but all had had years of experience, and were supposed to "know their job."

The greatest difficulty was to frame a course of lectures and demonstrations in order to cover as much ground as possible in such a short period, and also because the capabilities of the cowmen were an "unknown quantity." The practical side was obviously important, and demonstrations therefore

formed a large part of the course. The equipment at Sparsholt is superior to that on the majority of ordinary farms, especially as three different milking-machine units are used, but the size of the dairy herd at that time was under 20 milking cows.

The general outline of the course was arranged to cover the whole aspect of sound management to maintain healthy herds for the production of clean milk. Work started at 7 a.m. and continued until 8 p.m. with breaks for meals.

The following is a summary of the lectures and demonstrations given :—

Feeding of cows and feeding stuffs	8 hours.
Clean milk production	4 ,,
Recording competition (clean milk and milking)..	2 ,,
Sterilization of utensils	8 ,,
Milking machines..	3 ,,
Milk secretion	1½ ,,
Veterinary lectures	2 ,,

The lectures were given by members of the Institute staff, with some help from the County Lecturers, and by a member of the staff of the National Institute for Research in Dairying. In all cases the lectures were supplemented as far as possible by charts, etc., and were followed by demonstrations. The practical work consisted of milking instruction, but more importance was attached to the cleaning of sheds and cows, and the style and method of milking. After milking was completed the men had to clean and sterilize all utensils used, *i.e.*, buckets, strainers, refrigerator, milking machines, etc., each man being given a separate job which was changed daily.

In the feeding of cows, considerable ignorance of the ordinary foods in use was shown, and very vague ideas of weights of foods and forage were general. A keen competition was arranged in which each man had to feed cows with varying weights of hay, straw and concentrates, these being checked on the scales.

In the evenings from 7–8 p.m. informal talks were held, when questions and problems were invited from the men, and this brought out much useful information, and the men realized the value of the discussions in dealing with each one's own peculiar difficulties.

Such a course, which must be regarded as of rather an experimental nature, showed clearly that the following conclusions may be drawn :—

(1) That there is a demand among farm workers for increased knowledge in order to do their work more efficiently.

(2) That this is a sound means of increasing the activities

of agricultural education in the county and getting into very close touch with the farm workers.

(3) That the practical man is not always as careful as he should be, as, for example, in weighing out foods and carefully washing buckets. The general excuse, "there was not time," was shown, by better organization, to be untenable.

(4) That such practices as wet hand milking, use of uncovered buckets, excessive feeding of roots and coarse fodders, etc., are difficult to overcome, but even the oldest men were willing to try other methods.

(5) That even really good men find it very difficult to understand such things as "balanced rations," "coli in 1 c.c.," "sterilization," and so forth.

(6) That the value of such courses cannot be truly estimated, as with the interest of the men aroused, and their confidence obtained in such totally different surroundings from those to which they are accustomed, one cannot help feeling that their quest for knowledge will increase, and that the majority of the men in the future will endeavour to get a better knowledge of their work. Men who are working in herds in the Clean Milk Competition were most keenly interested in bacteria and their effects on milk.

(7) That the men attending such a course as this are better instructed by demonstrations than by lectures, as they can assimilate knowledge more easily through their eyes than by means of their ears.

In Hants we are convinced that such courses are most valuable, and they will be continued from time to time. The next course will be one for Poultrymen.

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Production of Home-Grown Beet Sugar

ACCORDING to returns made to the Ministry by the beet-sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during October, 1930, together with the quantity produced during the corresponding month in 1929, was :—

	cwt.
October, 1930	2,110,605
October, 1929	1,456,608

The total quantities of sugar produced during the two manufacturing campaigns to the end of October were :—

	cwt.
1930/1931	2,309,180
1929/1930	1,468,513

Potato Acreages in Scotland, 1930

THE following table, which has been prepared from a statement issued by the Department of Agriculture for Scotland, shows the acreages of potatoes grown in Scotland in 1930 with corresponding acreages in 1929 :—

	1930 *acres*	1929 *acres*
Total acreage grown	130,000	144,770
Total first earlies	13,120	15,144
Total second earlies	15,362	20,550
Total main crops	76,953	91,278
Total unclassified	24,565	17,798

Acreage figures for the most important varieties only are as under :—

FIRST EARLIES :—		
Epicure	7,703	7,939
Duke of York, etc.	1,794	2,408
Sharpe's Express	1,712	1,954
Eclipse, etc.	948	1,794
Ninetyfold	209	189
May Queen	127	317
SECOND EARLIES :—		
Great Scot	10,059	13,777
British Queen, etc.	3,518	3,530
Ally	339	962
Arran Comrade	331	404
Royal Kidney, etc.	252	697
MAIN CROP :—		
Immune		
Kerr's Pink	39,097	47,329
Golden Wonder, etc.	7,986	6,716
Majestic	5,657	7,537
Arran Banner	678	278
Arran Consul	617	1,610
Non-immune		
King Edward, etc.	15,146	15,324
Arran Chief	3,035	5,812
Up-to-date, etc.	1,195	1,657
Field Marshal	434	479

The total area under potatoes in Scotland has decreased by nearly 15,000 acres. It is noteworthy, however, that, in the main crop varieties, the acreage under King Edwards has decreased only slightly, while Golden Wonder and Arran Banner have increased in area. In the second earlies, Ally has decreased in acreage by approximately 65 per cent. and Royal Kidney by approximately 64 per cent. as against a general decrease of about 10 per cent.

The Scottish estimates of yield for this year are not yet available, but for comparative purposes it may be stated that the preliminary estimates for England and Wales indicate a yield of 6·1 tons per acre in 1930 as against 6·9 tons in 1929.

Young Farmers' Clubs: Annual Dairy Cow Judging Competition, 1930

THE annual dairy cow judging competition for Young Farmers' Clubs took place at the Dairy Show, by courtesy of the British Dairy Farmers' Association, on October 23, 1930. Nine teams contested for the *Farmer and Stockbreeder and Agricultural Gazette* silver challenge cup.

The cattle judged were of the Dairy Shorthorn, Ayrshire and Jersey breeds, there being four animals in each ring. Maxima of 60 points were awarded for placing, and 60 points for oral reasons. Messrs. M. D. Bannister and W. Burkitt acted as judges, and Professor J. A. S. Watson as umpire.

The contest proved very interesting, and attracted the attention of many spectators throughout the day. The cup was won by the Buckingham Royal Latin School Calf Club ("A" team) by 758 points, Cuckfield Calf Club being runners-up with 748 points. The scores were as follows:—

	Points
(1) Buckingham Royal Latin School Calf Club ("A" team)	758
(2) Cuckfield Jersey Calf Club	748
(3) Horsham Calf Club (Holders, 1929)	740
(4) Buckingham Royal Latin School Calf Club ("B" team)	734
(5) Northumberland Calf Club	712
(6) Bletchley Calf Club	593
(7) Collingham Mixed Club	590
(8) United Dairies Kingsclere Calf Club	550
(9) Withleigh Mixed Club	520

In the individual scoring the top place, with the award of the silver medal of the British Dairy Farmers' Association, was secured by John Arnison of the Northumberland team with 267 points. Thomas Busby of the Buckingham Royal Latin School, "A" team, was a close second with 264 points, and two girls, Thirza Hobgen and Elsie Tidy, of the Horsham Calf Club and Cuckfield Jersey Calf Club, respectively, tied for third place with 262 points. The bronze medal of the British Dairy Farmers' Association was awarded to each of these three competitors.

The cup and medals were presented to the winning team and competitors by Lord Daresbury, C.V.O., who complimented all the teams and competitors on their efforts.

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THE BIOLOGY OF SEEDS

Sir J. ARTHUR THOMSON, M.A., LL.D.,
Emeritus Professor of Natural History in the University of Aberdeen.

IT is a sight to see a great heap of wheat in a granary, or a living cataract pouring down a chute into the hold of a grain vessel. A living cataract! That is part of the thrill, for each of these grains of wheat is a living embryo, as well as a condensed store of chemical energy which man and beast can quickly turn into work and warmth. As we let the grains trickle through our fingers, it is interesting to think of our prehistoric ancestors who probably noticed the big kernels of the Wild Wheat growing on the shoulders of Mount Hermon, and set them apart for cultivation. This was doubtless the beginning of that long patience which led to such first-class wheats as Marquis—surely one of the factors that won the War.

It is still more thrilling to think back and back to the ages when there were no seeds whatever, for it seems certain, judging from the fossils, that there were no seeding plants before the time of the later Devonian or Old Red Sandstone. There were many plants before that, but they were not seed-bearers. How they multiplied without seeds is a difficult question, to which we shall return at the end of this article. It is at present enough to notice that none of the flowerless plants such as ferns and horsetails, mosses and liverworts, have any seeds in the true sense. These are confined to Flowering Plants.

The True Inwardness of Seeds.—Botany books often tell us that seeds are "the ripe ovules"—the outcome of the full growth of the small, whiteish bodies that we find inside the seed-box (badly called the ovary) of a flower. This definition is true enough, but does it not rather conceal the open secret that the seed is or contains an embryo, just as a fertilized egg does when the hen has brooded on it for a while? When we open a pea-pod and examine one of the seeds, we soon discover that it consists of two plump seed-leaves laden with stores of food, and that between these there is a tiny stem (plumule) and root (radicle), which will by and by sprout and grow. To understand how this embryo-plant came to be requires long study, but we must be content here to be very clear about the main fact that the embryo-plant developed, inside the "embryo-sac" of the ovule, from a fertilized egg-cell, just as if it were an embryo-animal. Thus a seed turns out to be a very young plant, usually well equipped with reserve

food-material (on which we so largely depend), and usually surrounded by firm protective envelopes. As the developing seed remains for some time in close union with the parent plant, from which it gets its food-materials both for growth and for storage, it may be compared without fancifulness to an embryo-mammal developing inside its mother's womb or uterus. In short, mammals and flowering-plants have achieved *viviparity*; that is to say, what is liberated from the parent is a young creature, already more or less advanced in development.

The Fitnesses of Seeds.—Every living creature that is at all complicated may be described as "a bundle of fitnesses," and although a seed is only beginning to live it shows many of these fitnesses or adaptations, some of them so intricate that long ages must have been needed for their gradual perfecting. Thus some seeds are particularly fitted for being scattered or sown. In most cases this is due to the fruits, which may explode—like the pods of whins and broom; or may be borne away on the wings of the wind—like the nutlets of dandelion- and thistle-down; or may attract the hungry eyes of birds, with the result that the undigested seeds are scattered far afield; or may adhere for a while to passing animals, as butter-burrs to sheep or cleavers to rabbits. In many a case, however, it is the seed rather than the fruit that is adapted for being scattered. Thus the hairs that form parachutes may be attached not to the fruits, but to the seeds, as in the case of cotton; or the outer wall of the seed may be almost waterproof, so that long floating in the sea may be possible without injury; or the outside of the seed may become gluey when wetted, so that fixation in suitable moist soil is readily effected. In many other ways the seeds are fitted for being sown, and this is just one instance of their adaptations. We must also inquire into their fittedness for lying low, their fittedness for resisting injury, and their fittedness for sprouting when the time comes.

Lying Low.—We must confess that we have never got rid of a feeling of mild surprise when we look round a seedsman's shop and see the bags of dry seeds—all, or nearly all, *alive*. There is no need to be ashamed of this wonderment, for no biologist understands as yet the state of latent life into which many living creatures are able to sink without dying. Active living matter usually contains at least 75 per cent. of water; but many seeds are dry and hard. Active living matter is in a colloidal state, *i.e.*, with innumerable particles or droplets

suspended in a fluid medium, but there is not much hint of this in dormant seeds. It must be remembered, however, that a great part of a seed may consist of stored food that never has much life about it, and does not develop into living tissues as the embryo itself must do.

In some of the higher animals, such as the badger, the fertilized egg-cell develops for a time into an embryo, and then stops for a long rest. Among the lower animals, also, this resting is not uncommon, and in the plant world it is particularly characteristic of seeds. They develop up to a certain point, and then they stop and do not begin again till they are getting ready for sprouting. It is natural enough that there should be a resting time after a period of development—life has many of these see-saws—but the quiescence may be thought of in other ways as well. Thus it might be very disadvantageous if the embryo-plant grew too big for the ovule or for the seed-box; and we must not too hurriedly say "Impossible!" for the embryo of the mangrove-tree develops so vigorously inside the fruit that it protrudes and falls off into the seashore mud. This works well for the mangrove, but it would be ruination in most plants. It may also be that after the ripening of the fruit and the withering of the flower there is little food available for the seeds.

In any case, it seems good sense to say that, for most plants, those kinds have succeeded whose seeds passed into a state of *arrested development*. This made it possible for the seeds to wait till the season was suitable for sprouting, or till they were sown in a suitable place. No doubt there are some seeds that usually germinate without a long rest, as in the case of willows, crucifers and grasses; but it seems safe to say that for most plants it is advantageous that their seeds should be able to lie low for a considerable time. It gives the seeds increased chances of life if there is no need for hurry, if they can simply wait for spring or until they are carried to a more suitable place. And if the embryo-plant can wait in a state of arrested development, that makes it more possible to have very protective envelopes and a very condensed and hard legacy of food.

If it be said that the embryo-plant *simply has to lie low* because of the hardness of the surrounding tissue and the seed-coats, and because of the unsuitable soil and weather, the answer is that this is not confirmed by the experiments of artificially removing the hard envelopes or of placing the seeds from the first in artificially hospitable conditions. More-

over, some seeds germinate best after more than one winter's dormancy. There seem to be deep advantages in a prolonged "lying low."

Tenacity of Life in Seeds.—Among the many errors that die hard is the sprouting of "mummy wheat." Man dearly loves a touch of the magical, and he is unwilling to give up the picturesque belief that wheat from inside a mummy-case may sprout after thousands of years of dormancy. There is the story of the man who bought some "mummy wheat" in Egypt and sowed it in Australia, where it germinated and grew with great vigour. There are many such "records," but in every carefully conducted scientific experiment the true mummy-wheat has refused to sprout at all. What happens in the ordinary popular experiments is the sprouting of *faked* mummy-wheat, that is to say, of modern seeds substituted for the ancient ones. The supply has to meet the demand; and we have heard that the alleged mummy-wheat sometimes grows into a variety that was not known in the time of the Pharaohs, but evolved in the early twentieth century! In any case, it may be safely said that if mummy-wheat germinates, it is not true mummy-wheat. So that's that.

At the same time it is certain that seeds may remain alive for many years. Thus, Becquerel proved that some seeds germinated after resting for eighty-seven years in a herbarium —a *hortus siccus* indeed. As regards the Sensitive Plant, a dormancy of sixty years has been demonstrated. In most cases, however, a tenth of that period would be considered a long dormancy; but it would be interesting to have fresh data on this subject from practical men, such as seedsmen, gardeners, and farmers. Different kinds of seeds differ in their power of lying low, and much may also depend on the nature of the medium in which they lie. It has often been noticed that the re-digging of a forsaken cottage-garden is followed by a reappearance of old-fashioned flowers that had not been seen there for years; but care must be taken to show that the reappearing flowers came from seeds that had been lying dormant and not from underground stems or the like which were stimulated by the exposure. Allowance must also be made for the possibility of some fortuitous fresh sowing, *e.g.*, of seeds included in the manure dug in, or of seeds carried on to the freshly dug soil by the wind, or on the feet of birds.

Protective Husks.—Seeds normally come to an approximate standstill in their development, being in a state of arrest when they are liberated; the quiescent state may be prolonged

after sowing, sometimes for a considerable period in natural conditions or for a still longer period in experiments. Yet a little more must be said in regard to the frequent insusceptibility of seeds to untoward external influences. This is familiar in Nature, where seeds often land in very unsuitable places, such as little crevices in a wall, and yet do not die; and more striking data have been furnished by experiments—by those of Becquerel in particular.

The life of the embryo within the seed is anything but assertive, and yet it is strangely tough. One reason may be found in the seed-envelopes which allow of little diffusion as long as they are dry. Becquerel fitted pieces of the tough seed-coats of peas and beans on the top of a tube of mercury, above a Torricellian vacuum, and found that no air was drawn through, even in the course of months. The seed-envelopes are gas-proof, as long as they are dry. When they are soaked in water, however, they show the gaseous absorption that one would expect.

In other experiments Becquerel showed that, in addition to the insulating seed-coats, there is extraordinary resisting power in seeds themselves. He perforated the envelopes of the seeds of wheat, mustard and lucerne, and subjected them to very inhospitable conditions without robbing them of their capacity for sprouting. Some of the trials which they withstood were extraordinary. He dried them in a vacuum at 40° C. for six months; sealed them up in an almost exhausted vacuum tube for a year; submitted them to the temperature of liquid air (−190°) for three weeks, and of liquid hydrogen (−250°) for three days; after which he put them on moist cotton wool—where they germinated as usual! Becquerel concluded that there was a complete cessation of the kind of activity we call "life"—which implies on its chemical side the down-breaking and rebuilding of proteins and other complex carbon-compounds. It is difficult, however, to call a seed "dead" if it can eventually sprout; all that we can say is that seeds may lose all signs of life without really dying.

Condensed Food.—Seed-plants proved very successful in the struggle for existence, partly because what was launched on the voyage of life was already a young creature; partly because of the perfection with which the seed-coats shut out injurious influences and enabled the embryo to lie low for a long time if need be; and partly because of the legacy of condensed food which was placed at the disposal of the young plant at the critical time of germination. This food is sometimes

in the embryo itself, sometimes in the embryo-sac, and sometimes in the surrounding ovule tissue; it may be large in amount as in wheat, or in small quantity as in orchids; it may be starchy, sugary, fatty or, best of all, proteinaceous; it may be softish or firm or, in rare cases like dates, almost as hard as bone. There are seeds and seeds. The most important biological facts are two: (1) that this legacy is very condensed, that it does not readily "go wrong" as long as the seed-coats are intact, but that it is fermented into fluid form before the time of sprouting; and (2) that it makes it possible for the sprouting young plant to resume development and growth until it is able to fend for itself by absorbing food from the soil and the air. If man had thought out the device of seeds, he would have been very proud of his invention!

The Evolution of Seeds.—We have left this question to the end, because even an outline of an answer is undeniably difficult; but it is well worth while to try to get hold of the clue. For many millions of years after plants began there were no seeds, the first seed-bearing plants making their appearance in the Upper Devonian Period amid the ferns and other plants of the flowerless forests. If we ask how there could be successful plants without any seeds, we may get the beginning of an answer if we take a withering fern-frond and shake it over a sheet of paper and notice the shower of "spores," which used to be called "fern-seed." These spores, however, are very different from seeds, being single cells, as light as air, whereas seeds are already embryo plants.

It is impossible, however, to stop here, for if we are able, *e.g.*, in a greenhouse, to watch a spore that sinks on to the moist soil we can see that it develops into a minute green disc, often about half the size of a threepenny piece. This inconspicuous disc or prothallus is actually the sexual fern—in great contrast to the asexual or spore-bearing fern with which everyone is familiar. On the under surface of the disc there are minute male and female reproductive organs, and, as is usual among living creatures, the egg-cell is fertilized by a sperm-cell and begins to develop into an embryo-plant, although this does not form a seed in ferns or in any of their (cryptogam) allies. In ferns it grows up from the prothallus and gradually develops into the spore-bearing fern-plant. This is what is called "alternation of generations"—the alternate occurrence in one life-history of two different forms differently produced. In the fern life-history the sequence is: Spore-bearing Fern—Spore—Prothallus—Egg-cell and Sperm-cell—Embryo—

Spore-bearing Fern. In this, however, there is nothing quite comparable to a seed.

It was not till about 1850 that botanists saw how to relate the ordinary flowering plants to the flowerless forms like ferns and horsetails, mosses and club-mosses. It was then that a genius, Wilhelm Hofmeister, had the insight to discern and the skilled patience to prove that the ordinary flowering plant is a spore-bearer, that has incorporated and well-nigh suppressed the sexual generation.

It is a difficult story, but a beautiful one, that the stamens and carpels of the flower are transformed spore-bearing leaves, that there are two kinds of spores—the pollen-grains made in the anther and the embryo-sac that is hidden away inside the ovule within the ovary. As far as the pollen-grain is concerned, the sexual generation (like a fern's prothallus) is restricted to the formation of three nuclei, one of which fertilizes the egg-cell. As far as the embryo-sac is concerned, the sexual generation (again like the fern's prothallus) is restricted to three cell-divisions in the embryo-sac, one of them resulting in an egg-cell.

From the fertilized egg-cell an embryo-plant develops, surrounded by more or less nourishment, while the outer walls of the ovule result in the protective envelopes. Thus we account for seeds, which began to be formed in certain extinct pioneering plants, many millions of years ago. The pioneer seed-bearers made their appearance in the Upper Devonian, as we have said, and became exuberant in the Carboniferous Period, when the coal-measures were laid down. They are called Seed-Ferns, or Pteridosperms, or Cycadofilices, the last name meaning that they show a combination of Cycad-like and Fern-like characters. They made one of the most important steps in the whole story of evolution. Where would Man be without seeds!

We are not pretending that it is at present possible to describe the precise steps by which the first seeds began millions of years ago, but Hofmeister discovered the main clue—that the spore-bearing generation incorporated a dwindling sexual generation; and Professor Bower has discovered another clue, that the ascendancy of the asexual "sporophyte" and the dwindling of the sexual "gametophyte" is to be associated with increased adaptation to terrestrial conditions. Dry land does not afford such a safe and soft cradle for egg-cells and embryos as the water does. Hence the great advantage of well-mothered seeds, which are not set adrift till they are relatively advanced.

Moreover, the fertilizing elements—the male-cells—of ferns and their allies are active ciliated cells, able to reach the egg-cell by swimming in water-containing spaces, *e.g.*, under the prothallus. But how difficult this would be in ordinary flowering-plants—a difficulty evaded by having insect-carried or wind-borne pollen-grains that adhere to the moist stigma of the flower, and send out a long pollen-tube feeling its way down the style towards the distant egg-cell in the embryo-sac. The fertilizing male element in the flowering plant is a nucleus that travels down the pollen-tube.

The long story should become vivid when we notice the remarkable discovery that out of the pollen-grain of Cycads and the Maiden's Hair Tree there come two or more motile spermatozoa or male-elements, very like those of ferns and their allies. We give flowering plants the technical name of Phanerogams, which means "with conspicuous sex," in contrast to Cryptogams "with hidden sex." The fact of the matter is that in flowering plants the whole of the true sex-generation has been so thoroughly hidden away that it needs a botanist to find it. But it was this that led to seeds!

* * * * * *

THE CONTROL OF WARBLE FLIES IN NORTH WALES

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THE problem of warble fly control is receiving the serious attention of the agricultural community throughout Great Britain. So much has been heard lately of the widespread losses which take place annually through the ravages of this pest that it is not intended to elaborate this aspect of the subject. On the other hand, farmers, appreciating the considerable damage caused by the warble fly, are becoming desirous, should economic factors permit, to join in any campaign initiated to bring about an effective control of this pest.

Infestation of Warbles in 1930.—It was anticipated after the fine, early summer of 1929 (rainfall in Bangor district from April to July, 8·45 inches) that the infestation of warbles in 1930 would be high. In the Bangor district, warbles began to appear on the backs of cattle as early as the second week in January. That this date is exceptionally early is evident from data obtained by Walton[1]* who, working in the same

* For references, see page 870.

area, writes "exceptionally early larvæ are now and again observed; one February 11, 1921, and another February 27, 1924." The size of larvæ was comparable. In the present observations in another district—Pwllheli—the infestation on February 11, 1930, is indicated by counts on two farms:—

FARM A (low-lying, wooded): 23 cows examined; 21 infested, averaging 5 warbles per animal (gross av. 4·5).
31 young fattening cattle examined, all infested, averaging 11·5 warbles per animal.

FARM B (high-lying, wooded): 16 cows examined; 14 infested, averaging 2·5 warbles per animal (gross av. 2·2).
9 young fattening cattle examined, all infested, averaging 11·3 warbles per animal.

Later in February, opportunity was afforded, under a large-scale demonstration scheme carried out in conjunction with the Madryn Farm School, for the examination of all cattle from the extreme point in the S. Caernarvonshire peninsula to about three miles inland. Thus, on February 24, 25 and 28, 243 cattle were examined in this area and 188 of these proved to be infested at this early date. The average number of warbles on the infested cattle (all ages) was 15·4 per animal (gross average 12·0) varying from 1 to 69.

This average at so early a date is abnormally high, for during Walton's observations (1920-1926) the highest (gross) average throughout the season was 9·14 warbles per animal, found in 1923 (rainfall during previous April to July 9·93 inches). Further, the highest average (gross) count taken in any one herd during those years was 13·8 warbles per animal on 14 young cows in 1926, whereas in the present observations in the S. Caernarvonshire area, at this early date, the average on a single herd of 18 animals (all ages) was 20·2 warbles per animal, while actually, on one small holding, the cattle, viz., 2 cows, 1 heifer and 1 bullock, gave an average of 32·5 warbles per animal! As all cattle in this district were subsequently dressed it was not possible to obtain comparable counts at a later date. This early and high infestation, however, was not confined to the S. Caernarvonshire and Bangor district, for, on March 4, a herd in Anglesey, comprising 11 cows and 7 yearlings, gave an average of 12·4 warbles per animal. Observations on cattle throughout N. Wales showed that the high infestation was general, and butchers have stated that it was one of the worst years for "warble damage" within their memory.

On observation cattle, *Hypoderma lineata* larvæ commenced to leave the back in the second week in March. With an

early infestation, it was hoped that all larvæ would have left early, thus making it unnecessary to carry out a late dressing. Unfortunately, this was not the case for, when the cattle in the S. Caernarvonshire area were examined on June 30, it was found that of 30 cattle examined, which had been treated with derris powder wash a month previously, 16 animals still had warbles, averaging 2·6 per infested animal. This point was important in an area where total eradication was being attempted, and it became necessary in the area to carry out the last treatment at this date.

Treatment of Cattle.—In addition to the aforementioned large-scale demonstration scheme, in which the ultimate results will become evident only after next and subsequent years, trials have been conducted for several years in North Wales with the object of selecting an efficient insecticide which could be recommended for general use against the warble fly. Walton,[2] following up the work of Bishopp[3] and others, had tried iodoform and vaseline, also derris powder and vaseline; these gave very promising results. The use of these ointments met the need of the, then, comparatively few farmers who were anxious to destroy the warbles, particularly on fat or dairy cattle. With a realization of the extensive losses due to the warble fly, there has come a general demand on the part of the agricultural community in the province for a method which can be applied easily on a large scale, and which aims at the eradication of the fly over large areas.

This demand was welcomed because the work of Bishopp and others had pointed clearly to the most promising insecticides for the destruction of warble fly larvæ, and it remained for the farmers to request that large-scale experiments be carried out to combat this pest. Anticipating such a demand, the writer has, for the last three years, carried out tests with materials likely to meet this need. The need is not only for a material that is cheap, easily applied, harmless to animals and odourless, but that is also highly effective *under ordinary farm conditions.*

Some of the materials tried were useless; others, though efficient, were too expensive or, while efficient under experimental conditions, did not give satisfactory results under ordinary farm conditions. The high toxicity of derris powder wash for the destruction of warble fly larvæ had been proved by Bishopp and others, and was further demonstrated in the Worcestershire experiments.[4]

Derris powder, of course, is the dried and powdered root of a tropical plant (Deguelia) of which there are several species. McIndoo[5] had shown that of eight powders used as "dusts" only three species were efficient as insecticides, whereas Fryer, Stenton, Tattersfield and Roach[6] showed that even supplies of derris from the same source may differ in toxic properties. Hence it appeared very necessary that the farmer should be guarded against buying derris powder which was useless for the destruction of warbles. It was, therefore, decided to carry out tests to ascertain the toxicity of derris powder wash made with derris obtained from various sources. Obviously, these sources should be those from which the farmers would normally obtain their supplies; hence derris was bought from local chemists and from firms who supply the local chemists in the different districts in N. Wales.

Method of Preparation and Application.—The wash was prepared according to Bishopp's formula (see also Advisory Leaflet[7]), viz., 1 lb. derris powder, ¼ lb. soft soap, 1 gallon water, the soft soap being first dissolved in a little hot water, then the quantity made up with cold water to a gallon and poured on to the powder. The resultant liquid (which must be thoroughly and periodically stirred) is a thick fluid with the derris powder in suspension. This was applied to the warbled area on the back of each animal, first of all by dipping a stiff cane brush in the solution and scrubbing the back to remove the crust around the warble hole, and following this by swabbing the warbles with a piece of soft cloth soaked in the liquid. Evidence was forthcoming that the wash will not retain its toxicity if kept more than a day or so after it is prepared.

Four monthly dressings proved necessary this season—commencing March 13-20 and ending June 20-July 4. There is some evidence, however, that the initial date of emergence of larvæ from the back might be of seasonal variation, and this is a subject of further inquiry.

Method of Experiments and Estimation of Results.—In the trials carried out previously, an opportunity was provided for arriving at a technique which would give reliable and comparable results.* It was found necessary to divide the trials into three distinct categories, as follows:—

DIVISION 1.—Critical experiments devised to ascertain the relative toxicity of the different materials when applied under ideal conditions favouring the materials. These were carried out

* A memorandum, giving details of the methods employed, has been prepared separately from this paper.

on 64 animals, and the writer undertook both application of materials and the counting of results. In this division, a careful map was made of each animal's back showing the position of each warble treated, while, in addition, the hair was clipped to mark the treated warbles. Animals with few warbles, or with warbles well distributed, were chosen for these critical trials, to ensure that the treated warbles could be detected with ease. Untreated warbles were marked as "controls" in the same way by clipping the hair and mapping.

DIVISION 2.—In these tests, the writer again undertook the application of material and the counting of the results, but the cattle were treated under general farm conditions as, for instance, when 150 untied cattle were dressed.

DIVISION 3.—Here the farmer was responsible for the treatment and the writer made the count of the percentage killed.

In this way, it was possible to test the efficiency of each material, (1) under ideal conditions when the actual toxicity could be ascertained; (2) under general farm conditions, when any variation due to personal error was eliminated; and (3) under ordinary and varied farm conditions.

The method adopted for obtaining the results is important, for, with the subsequent appearance of larvæ after treatment and, later in the season, the emergence of larvæ, unreliable and misleading results might easily be obtained. In the first place, there is the natural curve of prevalence of warbles from nil in the late autumn to a maximum in March or April (varying according to species, season, etc.) and then a subsequent decline. Hence, if a count is made of the number of warbles present at each monthly dressing, the natural decline in the number of the warbles per animal as the season advances might be mistaken for the effectiveness of the treatment. While this could partially be checked by retaining untreated animals as controls, such "controls" cannot be kept in areas where the destruction of all warbles is desired.

In the present trials, it was shown that if the examination was made at shorter intervals the experimental error was reduced to a minimum. It was found that the optimum period for observation was 15 days, for the killed warbles were then in a moderately advanced stage of decomposition, whereas larvæ which had pierced the skin after treatment were small enough to be counted as "subsequent appearances." Where necessary, a confirmatory count was made 21 days after treatment. Warbles that have been killed can be detected either by the black protruding portion of the warble from which may be extracted, by pulling, the complete black dead larva (see Fig. 1); or, later, when the protruding portion has been reduced to a mere black point it is then flush with

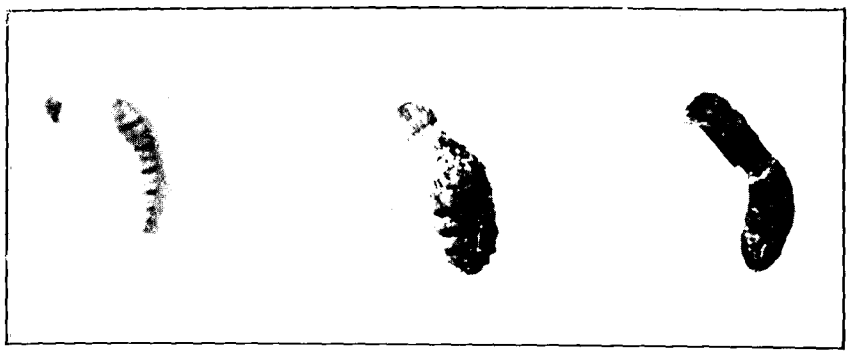

FIG. 1. Warble Fly larvæ destroyed by derris powder wash.

FIG. 2. Warble Fly larvæ beneath the skin of a cow.

THE CONTROL OF WARBLE FLIES IN NORTH WALES.

To face page 866.

the top of the orifice as compared with the live larva which (except just before emergence) lies slightly below the level of the orifice (see Fig. 2). Further, there is usually a yellowish exudation around the hole of a live larva. In other cases, where advanced decomposition has set in, the dead larva is enveloped with pus. In addition, previous experience had shown that it was advisable to carry out trials during February, March and early April before the general emergence of *H. lineata* takes place.

In the critical trials (Division 1) about 100 warbles were treated with each material and, at examination 15 days after treatment, no larva was marked " killed " unless removed *dead*.

In Division 2, a count was made of the number of warbles per animal before treatment, and 15 days later a count made of the number of *live* larvæ, which was checked by a count of the number of killed larvæ.

In Division 3, the cattle were visited 15 days after treatment and a count made of both *dead* and *live* larvæ, and the percentage kill was estimated from this. That the materials which proved inefficient in the critical trials in Division 1 simultaneously proved inefficient in Division 2 and Division 3 points to the reliability of the method adopted. Further, the handling of the cattle after treatment furnished ample confirmatory evidence that the counts taken were reliable.

Results of Experiments.—The materials used were as follows :—

1. *Derris powder from Source " X."*—This powder was buff colour, finely ground, and purchased at the retail price of 3s. 6d. per lb.
2. *Derris powder from Source " Y."*—A coffee-coloured powder, fibrous, purchased at the retail price of 2s. 3d. per lb.
3. *Derris powder from Source " Z."*—This powder was chocolate colour, fibrous, and purchased at 3s. 4d. per lb. It was claimed to be " biologically standardized."
4. *Derris powder from Source " Q."*—A fawn-coloured powder, finely ground, and purchased at 3s. per lb.
5. *Wash " A "* (containing essential elements of derris).—Thick solution, purchased at 5s. 3d. per pint to be diluted 1 in 7.
6. *Wash " B."*—As " A " above, but prepared on a less frothy base (not available in market).

The results in the critical tests (*Division* 1) are set out in the Table I.

Controls.—At each farm, and in each treatment, a number of warbles (approx. 10) was left untreated, and mapped and marked for future detection. These were examined 15 days later along with the treated warbles and removed in order to

TABLE I.—CRITICAL TESTS

Material		Cattle treated No.	Warbles treated No.	Warbles killed No.	Warbles killed per cent.
"X"	(powder) ..	12	93	93	100·0
"Y"	" ..	13	108	83	76·8
"Z"	" ..	12	104	103	99·03
"Q"	" ..	15	106	106	100·0
"A"	Wash ..	12	99	74	74·7
"B"	" ..	18	80	32	40·0

ascertain if they were alive. All such warbles proved to be alive save in a few cases which had obviously been hit by the horn of the animal and destroyed, when inflammation frequently followed. The results obtained in the general tests (*Division* 2) are given in Table II.

TABLE II.—GENERAL TESTS (Division 2)

Material		Cattle treated No.	Warbles before treatment Av. No.	Warbles after treatment Av. No.	Warbles killed per cent.
"X"	(powder)	25 yearlings (untied)	23 (15-56)	no live warble found	100
"Y"	"	35 yearlings (untied)	22 (8-61)	16 (0-25)	27·3
"Z"	"	(not included)	—	—	—
"Q"	"	20 fat cattle (untied)	11 (5-26)	no live warble found	100
"A"	Wash	22 yearlings (untied)	18 (7-31)	12 (0-22)	69·9

The results obtained under ordinary and varied farm conditions can obviously only be of a general character, but are valuable in conjunction with the foregoing. They are described as follows :—

TESTS UNDER ORDINARY FARM CONDITIONS (Division 3)

Material "*X*."—Many farmers had used derris powder from source "X," and 5 farms were visited 15 days after treatment in order to obtain a count of the efficiency of this material. On four of the farms a 100 per cent. kill had been obtained, for no live larvæ could be found. On the remaining farm a few live larvæ were found, but these were in unusual positions and no doubt had missed the dressing.

Material "*Y*."—This derris powder had only been used at a few farms, and 5 such were visited 15 days after treatment. It was very evident on handling the cattle that this derris had failed to produce a satisfactory kill and on a count being made the average kill was 40, 20, 20, 30 and 20 per cent. respectively (counts given to nearest 10).

Material "*Z*."—This derris powder was used mainly in the demonstration area, so that ample opportunity was available for estimating its efficiency under ordinary farm conditions. On most farms a 100 per cent. kill was obtained, and where this was not secured faulty application or preparation accounted for the results. This was adjusted at subsequent dressings.

Material "*Q*."—Only three farms supplied the data for the efficiency of derris powder from source "Q." At all these farms a complete kill was obtained.

Material "*A*."—This wash was used on a large number of farms, and about 20 were visited in order to obtain data regarding the efficiency of this material. It was very evident, on handling the cattle where this wash has been used, that the results did not come up to expectation. Five farms on which counts were made yielded 50, 75, 75, 40 and 75 per cent. of warbles killed.

Material "*B*."—This was not on the market.

Summary of Results.—The bulk of the derris powder sold to farmers in North Wales during 1930 was supplied from four different sources; powder from these sources was used in the trials along with two proprietary washes. When it was used as a wash, derris powder from three of the sources proved highly toxic to warble-fly larvæ under critical, general and ordinary farm conditions. Derris powder from the remaining source, while yielding a moderately high percentage kill under the critical tests which ensured sufficient solution entering each warble hole, failed to produce an effective kill under general and ordinary farm conditions. The writer is pleased to add that, in the case of the latter powder, the firm concerned, on being notified of these results, stated that no further supplies would be obtained from that source.

A solution which need only be diluted with water before application has, for obvious reasons, a distinct advantage over a powder, and it was hoped that a solution which was available would be found effective. Unfortunately, the only wash available for these tests failed to give more than 75 per cent. kill under ordinary farm conditions. It was at first thought that the frothy nature of the wash on application prevented the entrance of the solution; but a second sample was received which had been prepared on a less frothy base and showed no greater efficiency.

Cost of Application.—Derris powder, highly toxic to warble fly larvæ, was obtained last season at a retail price of 3s. per lb. This was sufficient to make 1 gallon of wash. The number of cattle that can be treated with 1 gallon of wash obviously varies with the degree of infestation with warbles, the care taken in application, etc. In the general tests (Division 2) above, with a heavy infestation, 1 gallon was sufficient to dress 50-60 cattle once. This was the initial dressing and naturally less wash would be required at subsequent dressings.

It is estimated, from the work in the Demonstration Scheme where small herds were involved, that 1 lb. of derris powder is sufficient to provide wash for four monthly dressings on a

farm with 20-25 infested cattle. On this basis, the cost for four monthly treatments should not exceed 2d. per animal.

Discussion.—From the preceding trials, it is evident that the farmer has at his disposal materials which, with ordinary care, are highly efficient in the destruction of warble-fly larvæ when applied under ordinary farm conditions. Derris powder wash is particularly suitable for this purpose, but, whereas most of the derris available to the farmers is highly toxic, the farmer must beware lest he obtains derris which is valueless for the destruction of warbles. Although, last season, few firms could give a guarantee of toxicity it should be possible in future to obtain such guarantee provided the firm can state that the derris was obtained from the same source or that it has been subsequently tested.

With the existence of an efficient and inexpensive insecticide, the control of the warble fly now depends very largely upon the co-operation of farmers in organized anti-warble fly campaigns. The advantage of treating cattle over large areas is obvious. During a period of agricultural depression, however, no additional expenditure upon insecticides will be undertaken unless prospects of a quick return are forthcoming. The farmer will receive the immediate benefit through the better condition of his treated cattle and he will also reduce the losses resulting from the "gadding" caused by the fly. The monetary value of these factors, unfortunately, is difficult to estimate, but several farmers who dressed their cattle for the first time this season have expressed the opinion that there was a decided improvement in the condition of the cattle after treatment. Further, there is evidence that the local butchers and dealers are fully alive to the situation and are prepared to pay 10s. to 20s. more for a non-warbled beast. These factors should encourage farmers to join in an anti-warble fly campaign.

Acknowledgments are due to the Agricultural Organizers of the counties of Caernarvon, Anglesey and Denbigh, and to Mr. Edwin Jones, M.Sc. (Madryn Farm School), for their co-operation in trials under the heading of Division B.

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WEEDS OF GRASS LAND

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ANY means that will enable the farmer to reduce the weed herbage in his grass land will, within reasonable limits as to cost, tend to increase his profits, (1) because the grazing is improved, and (2) because well-got hay from weed-free grass land containing plenty of young clover is richer, more digestible and more relished by stock. The reduction of weeds in grass land is intimately associated with the best means of grassland improvement.

Weeds in arable land are more readily observed than those in grass, but it is doubtful whether they are so easily reduced. Arable land may have the advantage that it provides periods when it is free of crops, but it must be recollected that when winter corn is taken it occupies the land for about ten months and so gives certain weeds every opportunity to be fruitful and multiply—to re-establish themselves. If grass land is really taken seriously in hand, and properly treated and managed, there is every expectation that rapid improvement will result, including severe reduction of the weed species. With continued good management the improvement should be permanent.

What the Improvement of Grass Land Involves.—In spite of the increased attention paid to grassland farming in recent years there is still a vast area of permanent grass which could readily be greatly improved. It is probably no exaggeration to suggest that at least one-half of our permanent grass (total for England and Wales 15,489,921 acres*) could be made to double its present annual output within ten years, while quite a useful proportion of mountain and heath land used for grazing (total for England and Wales 5,282,884 acres*) could be sufficiently improved to bring about a marked increase in its feeding value. The immense benefit which would naturally accrue in the course of such improvement would include a reduction in the weed flora. Indeed, any means that will really tend to the "improvement" of grass land automatically reduces weeds and the less valuable grasses.

Grass land is commonly termed meadow or pasture according as it is chiefly devoted to haymaking or grazing, although meadow land will be grazed after haying, while in some

* Agricultural Returns, 1929.

districts the fields are alternately grazed and reserved for hay. In general, too, any grass land which has existed as such for many years comes under the term *permanent pasture.*

Some of the best grazing land in the Midland counties is depreciated in value by the presence of excessive quantities of weeds, especially the Creeping Thistle, and it is held by some of the local farmers that the eradication of these weeds would lead to an increase of anything up to 20s. per acre in the annual value. Second rate and poor pasture can similarly be greatly improved, not only by reducing weeds but by increasing the yield and quality of the grasses and leguminous species—the improvement of the grasses being commonly the consequence of an increase in the leguminosæ.

It may be suggested that the loss due to the presence of weeds on grass land and the labour in cutting them is at least equal to 7s. 6d. per acre per annum on all the grass land in the country; and individual farmers may view their grass land with this figure in mind.

There may be differences of opinion as regards the figure quoted, but there can at least be no doubt that all farmers in every county are deeply interested in weed control, and it is clearly to their individual and joint benefit that they should combine forces and combat these insidious foes.

It may be held that reduction of weeds gives more space and more valuable herbage; rather would it be more accurate and desirable to observe that an improvement or stimulus of the grasses and clovers (especially wild white clover) means less space for and consequently an automatic reduction of weeds. The most important point to bear in mind, therefore, is the need for a general grading up of the herbage by all practicable and economical means. This is quite as important to agriculture as the grading up of stock, for if stock are the basis of successful farming it is clearly none the less true that good food and plenty of it is the basis of successful feeding. The improvement of grass land generally is of greater moment than an assault upon individual weed species—though these will rightly receive special attention to further the improvement.

The improvement of grass land involves a change for the better in the soil texture or sole, freer drainage, disappearance of "mat," a swing over from poor to good grasses, gradual reduction of weeds, frequently an increase in wild white clover, sweeter and richer herbage, earlier bite in the spring and later bite in the autumn, a steady grading up in fertility, and increased production of meat, milk and wool.

It is not intended here, nor is it desirable, to enlarge upon this side of the subject; a very useful account of grassland improvement is given in Bulletin No. 3.[1] It will suffice to emphasize the point that if weeds in grass land are to be reduced satisfactorily the principles to be followed must be such as make for a general improvement in the herbage. Soil and climate are both involved, and hence also drainage and manuring. Thoroughness of grazing is of much importance, as also are the encouragement of leguminous plants and the direct destruction of individual species of weeds. The general treatment of grass land—its "management"—must depend upon the soil itself, and upon local conditions. No definite rule can be laid down, and, subject to what may be said hereafter as to the various methods which make for improvement, each farmer must decide his own procedure.

The Worst Weeds of Grass Land.—It is by no means an easy matter to define specifically which are the worst weeds of grass land, because the species that are most troublesome in one district and on one soil are not necessarily the same as those that are worst in another district or on a different soil.

The composition of the herbage of any grass land varies to a considerable extent, according as to whether it be meadow, pasture, or hill grazing, and also according to locality, variation in soil, and aspect. Changes in the herbage also arise in consequence of good or bad management, and the mere grazing with one or other of the various classes of live stock may effect considerable alterations in the character of the herbage.

Numerous investigations have been made, at various times, into the botanical composition of the herbage of permanent grass land, and it has been demonstrated that many of Britain's best pastures contain a considerable proportion of so-called weeds.

As long ago as 1888 an investigation by Fream[2] showed that the species of plants found growing in old pastures are not very numerous. The plants to which he refers number 31 grasses (some of them, such as *Holcus lanatus*, being commonly regarded as weeds, though they may be highly useful in some situations), 8 leguminous plants, and 18 miscellaneous species of weeds not grasses or clovers. In a sub-

[1] Bull. No. 3 (*The Improvement of Grass Land*), 8d. post free from the Ministry. [2] *Jour. R.A.S.E.*, 1888, pp. 415-447.

sequent paper[3] he only found it necessary to mention 21 grasses, 5 leguminous plants, and 22 miscellaneous species or weeds. In the complete investigation, which involved the examination of 80 turves taken from pastures in 28 English counties, 6 Welsh counties, 8 Scotch counties and 11 Irish counties, the following weed species were found in the 80 turves :—

Bent Grasses (*Agrostis* spp.)	76 times.
Yorkshire Fog (*Holcus lanatus*)	63 ,,
Buttercups (*Ranunculus* spp.)	66 ,,
Narrow-leaved Mouse-ear Chickweed (*Cerastium triviale*)	49 ,,
Common Sorrel, or Sour Dock (*Rumex acetosa*)	32 ,,
Ribgrass, Ribwort, or Plantain (*Plantago lanceolata*)	25 ,,
Hawkbits (*Leontodon* spp.)	19 ,,
Self-heal (*Prunella vulgaris*)	14 ,,
Daisy (*Bellis perennis*)	11 ,,
Yarrow (*Achillea millefolium*)	10 ,,

Excluding Yarrow, Yorkshire Fog, and even Bent, which in certain circumstances are useful plants, the remaining species include the really significant weeds present in the pastures, others being in very small quantities and not of such agricultural interest. Many other weeds, however, were found more than once. The complete list of "miscellaneous" species mentioned, comprising "weeds" apart from grasses and leguminous plants, is as follows, in alphabetical order :—

Achillea millefolium L.	Yarrow or Milfoil.
Bellis perennis L.	Daisy.
Bunium flexuosum With.	Earth-nut.
Cardamine pratensis L.	Cuckoo Flower.
Carduus spp.	Thistles.
Carex spp.	Sedge.
Cerastium triviale Link.	Mouse-ear Chickweed.
Leontodon autumnalis L.	Autumnal Hawkbit.
Leontodon hispidus L.	Rough Hawkbit.
Luzula campestris L.	Field Woodrush.
Plantago lanceolata L.	Ribgrass, Ribwort, or Plantain.
Potentilla anserina L.	Silver-weed or Goose Tongue.
Prunella vulgaris L.	Self-heal.
Ranunculus acris L.	Upright Buttercup.
Ranunculus bulbosus L.	Bulbous Crowfoot or Buttercup.
Ranunculus repens L.	Creeping Crowfoot or Buttercup.
Rhinanthus crista-galli L.	Yellow Rattle.
Rumex acetosa L.	Common Sorrel or Sour Dock.
Rumex crispus L.	Curled Dock.
Sonchus spp.	Sow Thistle.
Taraxacum officinale Web.	Dandelion.
Veronica chamædrys L.	Germander Speedwell.

[3] *Jour. R.A.S.E.*, 1890, pp. 359-392.

The extent to which some of the weeds occurred in the pastures was also ascertained ; it was found that 13 out of the 80 turves were composed to the extent of 50 per cent. and upwards of "weeds," the highest figure being 89 per cent., and the average of the 13 no less than 65 per cent. On the other hand, 28 contained only from 0 to 5 per cent. of "miscellaneous" or weed herbage, while the remainder (39) contained from 5 to 49 per cent. It must, however, be noted that the turves were growing under somewhat unnatural conditions, and the weeds often tended to become exaggerated, especially in the case of *Rumex acetosa*. In one case, 89 per cent. of the herbage consisted of weeds, but Fream remarked, "This turf showed early signs of an abundant growth of *Achillea millefolium*, and at length it became smothered with this plant to an extent which would never be possible in continuously grazed land." In several cases, upwards of 70 per cent. of the miscellaneous herbage was *Rumex acetosa*.

Yet we find it stated that 5 acres of a pasture in North Staffordshire, from which the turf examined consisted of 67 per cent. "miscellaneous" herbage, the balance being 32 per cent. grasses and 1 per cent. leguminous, would "fatten four shorthorn barreners between the middle of May and the beginning or middle of August in a fairly good season ; they will afterwards fatten, say, a dozen or fifteen wether sheep." It is clear that in well-grazed pastures the bulky "miscellaneous" herbage is kept down, and "under the normal treading and grazing of stock, such species as *Achillea millefolium*, *Leontodon* sp., *Rumex acetosa*, would never make the display which characterized several of the turves."

It seems likely that these well-grazed pastures were particularly rich in virtue of their being kept short, and that the weed herbage, being young and leafy, was perhaps nearly as good as the grass itself. Work in this direction is being done by Stapledon at the Welsh Plant Breeding Station at Aberystwyth, and it may conceivably prove true that certain weed species may be regarded as valuable fodder so long as they are kept grazed so close that they remain young and leafy.

In 1890, in a report of some observations and experiments on some English pastures,[4] Carruthers (then Consulting Botanist to the Royal Agricultural Society) referred to the examination of some of the pastures from which Fream's

[4] *Jour. R.A.S.E.*, 1890, p. 95.

turves were cut, and although he did not come to the same general conclusions as Fream, he found that weeds constituted in some cases a large proportion of the herbage. For example, a Dorset pasture carried 22 per cent. of Ribgrass (*Plantago lanceolata*), 9 per cent. of Bugle (*Ajuga reptans*), 8 per cent. of Buttercup (*Ranunculus acris*), 4 per cent. of Yarrow (*Achillea millefolium*), and 3 per cent. of Knapweed (*Centaurea nigra*). In another case, a Somerset pasture carried 63 per cent. of Ribgrass and 8 per cent. of other weeds. Carruthers concluded that of the fourteen pastures he visited, not one "is so good as it might easily be made. The extraordinary abundance of such objectionable grasses as Yorkshire Fog and Meadow Barley-grass in some of the pastures is surprising." He further observed that, "A plant of Nature's sowing on his (the farmer's) farm, where it should not be, is a weed to be eradicated. . . . In laying down land to pasture, as in sowing fields with wheat or any other crop, we must try to surpass Nature. We must bring together the most nutritious perennial plants which will supply palatable food for stock as far as possible all the year round, and we must exclude the weeds and worthless grasses which we have found too abundant in natural pastures."

In 1907 Armstrong reported upon an investigation into the composition of the herbage of several types of pasture and meadow land, especially fine old pastures in the Market Harborough district of Leicester and Northampton. His conclusions[5] are of considerable interest, among them being :—

(1) That white clover and ryegrass form by far the greater part of the herbage of the best grazing lands—both old and recent in the English Midlands—and that the next most abundant species on these pastures are usually crested dogstail, bent (*A. stolonifera*), and rough-stalked meadow grass.

(2) That the herbage of the inferior types of grass land in the same districts consists very largely of bent grass (*A. vulgaris*) and various weeds, while white clover and ryegrass are present in comparatively small quantities.

(3) That the only other species of grasses which are occasionally abundant in these pastures are cocksfoot and sheep's fescue in the better fields, Yorkshire fog and tufted hair-grass in the poorer ones.

(4) That the herbage of a pasture varies botanically to a considerable extent during a season, this variation being, however, determined very largely by soil, situation, and weather.

* * * * *

(9) That the quantity of herbage available per acre for grazing depends much upon the density of the herbage, and that no

[5] *Jour. Agric. Sci.*, December, 1907.

plants appear to be more capable of producing a dense growth of herbage than white clover and ryegrass, providing the soil is suitable for them.

(10) That the number of individual plants per acre on the best old pastures, and necessary for the production of a thick, close turf, is probably very much less than is usually supposed.

In the course of an inquiry some twenty years ago in which 29 practical agriculturists were asked by the writer to state what they considered to be the six worst weeds of grass land in their neighbourhood, an analysis of the replies showed that the following species were considered to be the worst weeds in the stated number of instances :—

Thistles	22
Buttercups	16
Holcus lanatus and H. mollis	9
Docks	8
Daisy	7
Plantain	6
Soft Brome	6
Yellow Rattle, Sorrels, Dandelion, *Agrostis* spp. each	5
Knapweed, Rushes, Nettles each	4
Ragwort, Hassock Grass, Rest Harrow each	3
Moss, Self-heal, Sedges, Hawkweed (*Hieracium*), Bracken, Mountain Flax, Scabious, Meadow Saffron each	2
Sweet Vernal, Rough-stalked Meadow-grass, Mouse-ear Chickweed, Couch, Ox-eye Daisy, Pig-nut (*Conopodium*), Cow Parsley (*Petroselinum*), Meadow Barley-grass, Cat's-ear, Corn Marigold, Stinking Mayweed, Wild Carrot, Cowslip, Broom, Gorse, Dyer's Green-weed, Silver-weed each	1

It is deserving of note that a considerable number of these species are not mentioned more than once or twice, some are often held to be useful, while one or two of them at least (Corn Marigold, Stinking Mayweed) are mainly weeds of arable land. Many such weeds, however, may prove very serious pests, and the fact that they are mentioned as among the six worst weeds of any given district is sufficient to show that where they grow an endeavour should be made to reduce them.

Extensive grassland trials conducted in 1927 led to a statement[6] as to the distribution and development of weeds on the various areas of grass land concerned; and it is observed that some opinion can be formed of the weed distribution in the centres from the following list of percentage frequencies :—

[6] *The Intensive Treatment of Grass Land*, The Rt. Hon. Lord Bledisloe, K.B.E., 1928.

Species	Percentage frequency
Thistles (*Carduus* spp.)	63
Sorrels (*Rumex acetosa, R. acetosella*)	50
Creeping Crowfoot (*Ranunculus repens*)	50
Rib Grass (*Plantago lanceolata*)	41
Daisy (*Bellis perennis*)	41
Docks (*Rumex* spp.)	34
Stinging Nettle (*Urtica dioica*)	28
Bitter Buttercup (*Ranunculus acris*)	25
Hawkbits (*Crepis* spp., *Hieracium* spp.)	22
Woodrush (*Carex* spp.)	19
Yarrow (*Achillea millefolium*)	19
Hoary Plantain (*Plantago media*)	19

The fact that the first three of these species occurred at half or more of the centres is significant. It deserves to be recognized, however, that species which may be highly injurious weeds on poor, neglected and run-out pastures and meadows, may prove to be of little importance on fertile and closely cropped grass land. Indeed, in some situations species commonly regarded as bad weeds are likely to be considered in quite another light—as useful in providing acceptable green fodder where clovers and good grasses are far from plentiful. It might perhaps be suggested that, taking the country as a whole, and allowing for differences due to soil and situation —which may change the outlook somewhat—the following species, jotted down almost haphazard, may be regarded as the worst grassland weeds :—

Bracken	Rushes	Heather and Heaths
Thistles	Sedges	Daisy
Buttercups	Rest Harrow	Woodrush
Sorrels	Dyer's Green-weed	Yarrow
Docks	Nettles	Cow Parsleys
Ragwort	Mosses	Yorkshire Fog
Ox-eye Daisy	Hawkweeds	Creeping Soft-grass
Knapweed	Silver-weed	Soft Brome
Dandelion	Self Heal	Hassock Grass
Yellow Rattle	Gorse	Mat-grass
Horsetails	Broom	*Brachypodium* spp.

* * * * * *

LEONARD MEAGER AND THE "MYSTERY OF HUSBANDRY," 1697

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WE know very little of the life of this writer : like so many other early writers on farming and gardening, almost all we can learn of him must be gathered from his books. We do know, however, that he was for some time a gardener to Sir Philip Hollman, at Warkworth, in Northamptonshire, and by so much must admit his claim to be considered a practical man as opposed to the many theorists who wrote farming books in the heart of the metropolis.

The motive which actuated him was, according to his Preface, to supply what had been omitted by other writers, who had, in his opinion, " come short of what was, no doubt, well meant, because most of them had not practised what they had writ, but were obliged to borrow them from others and to take them on Trust, and many of them from Foreign Authors; not well considering that different Climates produce different Effects though things are managed one and the same way . . .

" These things, I say, consider'd, I have grounded this work upon long Experience, and truly proved to my great Advantage, whatever I have laid down."

This was, as Donald McDonald says,[1] sound logic, and is indeed the foundation, upon which, with some amplification, modern agricultural science and practice has been built. McDonald adds rightly that Meager seems to have carried these advanced ideas right through his book in a manner which commands respect for the man and his methods.

To this encomium the remarks of an earlier writer are an apt addendum.[2] " Though no notice is made of animals," he says, " Meager's book must be reckoned a very considerable advance in the progress of agriculture. The matter is better arranged than by the previous authors, and the subjects are sooner related and more quickly dismissed. The title page is still loaded with the contents of the work, and the prefaces are lengthy and the dedication clumsy. Still a large progress has been made."

The modernity of some of Meager's views is exemplified by his comparison of the advantages derived by the State from the activities of the merchant and the farmer, except that the

[1] *Agricultural Writers*, 1200–1800. 1908, p. 148.
[2] John Donaldson : *Agricultural Biography*, 1854.

verbal expression of his opinions is not in the modern fashion of brevity, and appeals to Divine Authority for its confirmation.

"The Excellency of Husbandry," he says, "appeareth partly by its Antiquity, as we esteem Things to be more Admirable, the more Ancient, the nearer they come to God, the First Being of all Beings . . . The Merchant is a gallant Servant to the Common-wealth, he fetcheth its Riches from far, and he is a worthy Contributor to the Wealth and Prosperity of the Kingdom; but he produceth it from others. But this Merchant of Husbandry, he raiseth it out of the Earth, which otherwise would yield little, unless his Ingenuity digged and fetched it out. What rates purchased he it at? Even only by his own ingenuous Industry and with the Wages of his Labouring Man, whom he is bound both by the Laws of God and Nature to allow a Competent Maintenance."

A large portion of the first part of the book which he hopes will be so useful to these estimable members of society is devoted to the preparation of the soil for crops, because, as Meager says, "In Ploughing and Ordering, and right preparing of the Ground for Seed, consists the chiefest Point of Husbandry," and the crops must be suited to the soil in which they are planted and to the disposition of the Heavens over that soil. In this connexion he sets out the order of merit of the different animal and bird manures, and commends the lupin as a green manure "before he bear his Cod." The making of compost is described. Straw and fern, etc., should be laid in a ditch to rot "with the filth of sinks and privies, but in the midst you must lay some sound Substance, against the breeding of Adders and Snakes . . ." The intermixture of superstition with sound practice is further demonstrated by the advice to lay most dung at the top of sloping fields so that it may be washed down, coupled with that to do manuring when "the Wind is Westerley and the Moon on the Wayne." We now know, of course, that the moon has no influence on crop growth although it seems still necessary to say so.[3]

Marl, lime, chalk and clay as dressings for different types of soil form a constant subject for the agricultural writers of the time, and Meager does not hesitate to say that the Germans use the first of these successfully, which seems to intimate that some, at least, of his protestations of deriving the whole of his teachings from his own experience are ill-founded.

[3] C. F. Marvin: *Calendar in History and Success of Farming*, U.S. Year-book of Agriculture, 1928, p. 177.

When he goes on to the improvement of barren ground we find that he owes a large debt to his predecessors in his chosen field of literature, practically the whole of Chapters IX to XIII being transcribed, sometimes verbally, and sometimes in paraphrase, from *Markham's Farewell to Husbandry* (1620), while his exordium on the value of pigeon's dung for heavy wheat land is derived from Gabriel Platte's *Discoverie of Infinite Treasure* (1639). The details of the methods recommended for the reclamation of waste and heath and its use for alternate husbandry are not, however, without interest.

He expresses a more personal opinion in the controversy as to the use of oxen or horses as plough animals. "Where Horses may be used, they are more commodious for the Plough, and the fewer of them the better; for many Horses draw too hastily, and make too large Furrows, which is not good." Here again he garners wisdom from a continental practice, stating that they only use two horses to a plough in the neighbourhood of Cologne and do very good ploughing, but he also refers to a light plough used with light horses in Norfolk. This was evidently the type so much praised by Arthur Young a hundred years later. Sometimes a harrow was fastened behind this light plough and used with it, and this practice is said to have been in good esteem in the county. Breaking up immediately behind the plough, often a good practice, is apt to be regarded as something new. Meager's implement was probably very narrow and light.

The most necessary ploughs to be used in England are of four main sorts: (1) the single wheel and foot plough; (2) the wheel plough called the double wheel plough; (3) the simple plain plough without wheels or foot; and (4) the Dutch bastard, or plain Dutch plough. Meager gives instructions for building these types; all kinds of ploughs are, however, useful in some sort of land or other. A frontispiece to the book shows these types of implements, and, as Donaldson has observed, "The portraits of the implements are the exact delineations given by Blyth in his book of English Improver Improved, which fact, with the same descriptions given by Meager, show that no improvement had taken place in respect of ploughs during the half century that elapsed betwixt the dates of the publication." In spite of all that has been written about the vast progress made during the eighteenth century Lord John Somerville made much the same remark a hundred years after Meager! In his book he suggests he will "save those who search after improvement much trouble and confusion, by

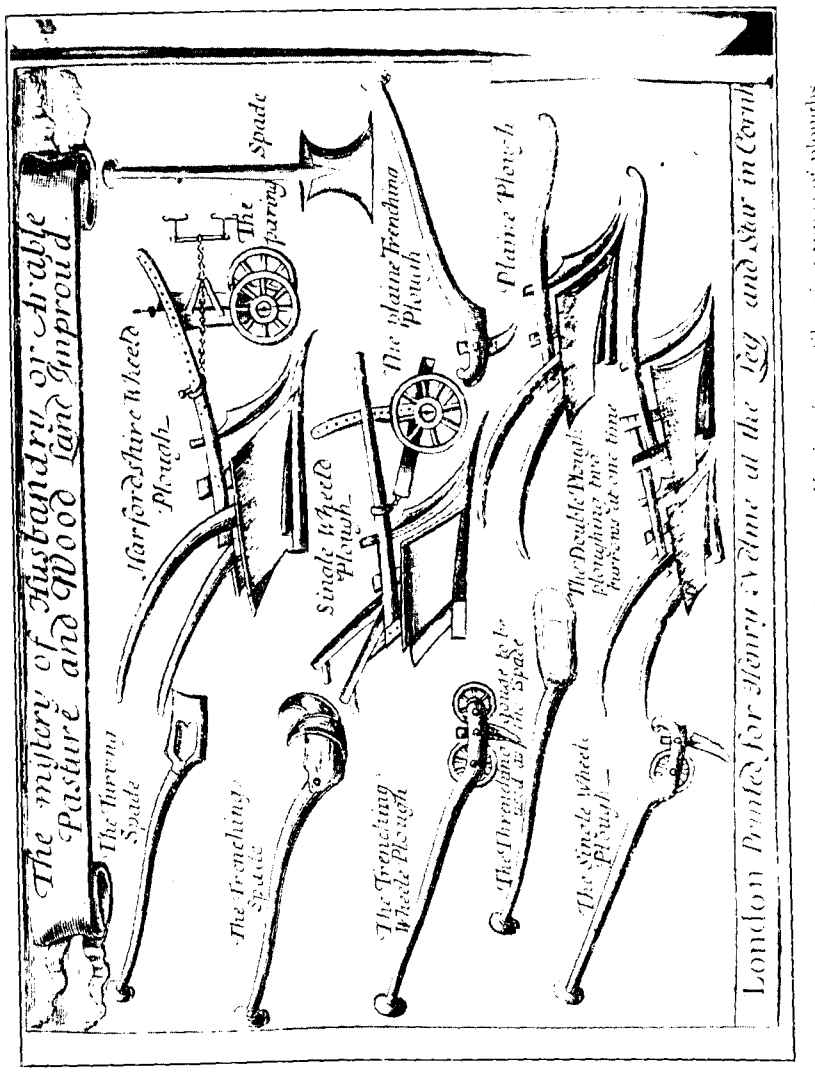
giving a copy, or facsimile, of ploughs then in use, taken from a treatise written by Walter Blith, about the year 1653, by which, at once, we perceive how little originality of invention or improvement has been manifested in the greater part of the swing and wheel ploughs constructed within the last hundred and fifty years. Two or three exceptions there are, which shall be immediately noticed."[4]

The ploughs of which Meager speaks were, of course, made of wood and fitted with an iron share preferably "well steel'd," a coulter and sometimes a plate of iron fastened to the mouldboard to take the wear. Bearing this in mind, as well as the fact that the ploughs were made locally, we can appreciate some of Meager's remarks. The plough, he says, should be rather made to be suited to the irons, than the irons to the plough, because in the second case it will be in a manner worn out before it works easily. Again, the plough maker who makes according to a rule he has only learned by trade, not knowing how to hold a plough, if he makes a true plough, must rather hit it by guess than infallibility. The evils of using a plough not suited to the soil in which it is working are listed, "the Cattle may be spoiled, the Men toiled, and the Plough spoiled, and yourself disappointed in the well ploughing of the Ground." Many good ploughs, however, are spoiled in the using, and for this reason, the ploughman ought to be a judge of ploughwright's work; he should not try out a new plough on rough land. A very modern note is struck by the axiom, "the irons wear bright and clean, it is a proper sign of workmanship on his (the wright's) part."

Draining was another subject that occupied a good part of the attention of writers of this time. Meager does not perhaps pay so much attention to this subject as some others. He suggests that moors should be drained by gutters, and that "Reeds of Fetches, Pease straw or that of Lupins" should be ploughed in for their manurial value; and describes a single coulter trenching plough to cut one side of a trench at a time, called the Trenching Plough, as well as a Trenching Spade which from the illustration may also be derived from Blith. The land drained will, he says, bear excellent wheat, rye or barley, if treated in accordance with the precepts he has laid down for barren land.

Naturally also, we find instructions for growing what were then known as artificial grasses, because the seventeenth century

[4] *Facts and Observations Relative to Sheep, Wool, Ploughs and Oxen*, 1809, p. 129.



Frontispiece to Leonard Meager's *Mystery of Husbandry*. Showing types of ploughs for use in England.

was the period of their introduction into English farming. "Claver" is good for land exhausted by corn "that it will bear it no longer," and the home-produced seed is as good as that imported from Holland. A gallon, or 12 lb., should be sown per acre, and the seed should be mixed with earth to ensure good distribution in broadcasting. It may be grazed from October to January, and its feeding will return a profit of £12, as it will grow on land worth 20s. an acre and last good for five years with a little manure.

St. Foin (sainfoin) or French grass is good for seven years and then as green manure for corn. Lucerne grows well on dry, barren land, but is not very common, "nor has any considerable improvement been made of it in this Kingdom; however, it may be proper for barren lands of little value for anything else."

Turnips will provide "Winter-stores for yourself, plenty for your Cattle, and the like for the market, if you live near any good Towns; this being a very wholesom, moist, cooling and nourishing Root, good against Feavers, and all hot Diseases, allaying the acrimony of the Blood." Carrots and parsnips also receive praise, but it is a little surprising to find praise of potatoes, which did not come into general use as an article of human diet until many years later, the first book on the tuber having only been published about 30 years before Meager's own production.[5] Meager did not, like so many others, doubt their usefulness as human food. He says: "Another good thing that may make good improvement, though not in such a general manner, are Potatoes; these being once in the Ground will spread extreamly . . . they are very nourishing and wholesom to the Stomach, and a little piece of ordinary Ground will produce a sufficiency for the use of many Families a whole Winter, and many succeeding Winters, their encrease being very great . . ."

Flax and hemp are also, according to Meager, improving crops and he favours hops and the dye plants, such as madder, weld and woad, and saffron. In connexion with his remarks on these plants he gives us some idea of the districts in which they were cultivated. Saffron, for instance, grew abundantly when cultivated in Suffolk, Essex and Cambridge, and the best natural parts for woad were some districts in Worcester, Warwick, Oxford, Northants, Gloucester, Leicester, and Bucks, and some other places, a sufficiently wide area. Such informa-

[5] John Forster: *England's Happiness Increased*, 1664.

tion is of great historical interest and similar details are included in some general advice.

". . . in stiff Clays, of which all the fruitful Valleys of this Kingdom are composed, as also in *Huntingdonshire*, *Cambridge-shire* and *Bedford-shire*, and many others, all manner of Arable business must be begun early in the Year, and the Ploughs, and Instruments to be used, made of the longest size, the Timber strong, and the Labour great and painful; so also in Soils that are mixed, and very good and fruitful, as *Hertford-shire*, *Northampton-shire*, and most part of *Berkshire*, *Essex* and *Kent*, with other Counties of the like nature, Arable Labour ought to begin in the latter Season, and the Instruments and Ploughs, made of a middle size, and the Timber indifferent, and less labour will serve than in the former: but the light Sandy Grounds, having a natural fruitfulness in them, as *Surrey*, *Suffolk*, *Norfolk*, and many parts of *Lincoln-shire*, *Hampshire*, etc., the Arable Toils may begin at the last Seasons, and Ploughs, with Instruments, may be of the smallest and lightest size, and Timber smaller than the former, and the Labour less.

"As for all barren unfruitful Earth, as in *Cornwall*, *Devon-shire*, many parts of *Wales*, *York-shire*, *Cheshire*, *Lancashire* and *Derby-shire*, and the like, the ploughing and ordering is to be at a fit Season, according to the temperatures of the weather, which if it happen early, you must begin your Labour at latter Seasons."

In an approval of inclosure, made many years before the intensive enclosure by Parliamentary process of the eighteenth century, he says: "Where the Grounds are inclosed, how happily people live; as in Hertfordshire, Essex, Kent, Berkshire, Surrey, Wiltshire, Somerset-shire, Hamp-shire and others, all which not only raise Corn for themselves, but supply other open Counties, and even the great City of *London*, which consumes a vast quantity thereof; and yet no parts of England set a greater rate, or make a greater advantage by Grazing."

The book also contains information about timber trees, and a commendation of the practice, common in Hereford, Worcester and Gloucester, of planting fruit trees in the hedge rows. It concludes with a Countryman's Almanack, which, however, only contains weather signs and some superstitions such as the unfortunate and fatal days of the year, and the Nativity of our Lord falling on any day of the week thereby showing the disposition of the Year.

Meager also published two books on gardening, one in 1670 and the other in 1697. The first of these was dedicated to his employer and deals with Fruit trees, the Kitchin Garden and the Garden of Pleasure, including various lists of plant names. The book published in 1697 has an interesting introduction which ends with the pious hope: "May the Bookseller have so much profit in the selling it, and thou the same Pleasure and Profit in buying it, that has accrued to me by Collecting, and Experience therein;" . . . The matter is set out differently from that in the earlier publication and the book contains chapters on cider- and perry-making, etc.

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* * * * * *

TWO EXPERIMENTS ON TAPIOCA MEAL AS FOOD FOR PIGS

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IN the issue of this JOURNAL for May, 1929, an account was given of an experiment, conducted at the Harper Adams Agricultural College, with tapioca meal or root flour, comparing it with maize meal as a source of digestible carbohydrates in the ration of the fattening pig. As comparatively little barley is grown in the Isle of Man (oats forms practically the sole cereal crop), and pig feeders are dependent very largely upon imported supplies of barley meal, maize meal and millers' offals, except in cases where dairy products and potatoes are available, it was decided that the possibilities of tapioca-root flour as a cheap source of carbohydrates were worthy of serious consideration, and it was resolved to make a comparative trial of maize meal and tapioca root flour at the Experimental Farm of the Board of Agriculture for the Isle of Man. At the time the article referred to was published tapioca-root flour was several pounds per ton cheaper than both barley meal and maize meal. The extra freight on goods to the Island provided a further inducement to explore any avenue likely to lead to the reduction of feeding costs.

FIRST EXPERIMENT

Live Stock.—Twenty-three pigs were available. They were bred on the farm and were the progeny of one Large White and two Middle White sows. All three litters were sired by the same boar, a pure Large White. The pigs were weighed when four weeks old and again at nine weeks. Sixteen pigs that showed the most uniform rates of growth between the first and second weighings were selected for the experiment. They were divided into two lots, as evenly as possible with regard to sex, litter and weight. Each lot contained two gilts, and the boars of the litters were castrated at five weeks old. The live weights of the tapioca group ranged from 32 to 43 lb., while the maize meal group ranged from 30 to 41 lb. The average live weight of both groups was 36½ lb. The experiment began on July 30, 1930, and finished when the pigs were 29 weeks old on December 17. The pigs were weighed at weekly intervals throughout this period. At all times, weighing was done first thing in the morning before feeding, and, at the conclusion of the experiment, the final weights were taken as being the average of three weighings on the last three consecutive mornings.

Rations.—The scheme of rationing was based on the recommendations contained in the Ministry's Miscellaneous Publications No. 48, "Pig-keeping." A basal ration of sharps, barley meal and fish meal was common to both groups. At a later stage, palm kernel cake meal was added to the basal feed. Lot No. 1 received tapioca-root flour in addition to the basal ration, while Lot No. 2 had a similar proportion of maize meal.

On July 30, the composition of the rations was :—

	Lot No. 1 per cent.	*Lot No.* 2 per cent.
Sharps	60	60
Barley meal ..	20	20
Fish meal ..	10	10
Tapioca-root flour	10	—
Maize meal ..	—	10

When the pigs were twelve weeks old, the proportion of tapioca-root flour and maize meal was increased to 20 per cent. and later, at the 20th week of age, to 25 per cent., at which it remained to the end of the experiment. Palm kernel cake meal was introduced into the basal ration when the pigs were 12 weeks old, and was fed at the rate of 20 per cent. of the total ration up to the last five weeks, when it was replaced by crushed oats. The fish meal was diminished progressively after the pigs were 20 weeks old and was cut

out entirely from the feeding during the last five weeks. All changes in the rations were made gradually. The final ration was :—

	Lot No. 1 per cent.	*Lot No.* 2 per cent.
Sharps	20	20
Barley meal ..	35	35
Crushed oats ..	20	20
Tapioca root flour	25	—
Maize meal ..	—	25

General Management.—Throughout the period of the experiment, the animals were housed in loose boxes, with abundant light and ventilation. Both groups fed satisfactorily from the beginning. The mixtures were fed dry, and the method followed was to allow the pigs as much as they would clean up in a given time. Feeding was done three times per day in the initial stages of the experiment, but was subsequently reduced to twice only. The pigs had water always before them.

The health of both lots was excellent. The pigs in Group No. 1 developed a slight skin eruption during the third week of the experiment, but after the administration of a dose of salts the trouble disappeared.

With regard to palatability, there was nothing to indicate that maize meal was superior to tapioca-root flour, nor did the tapioca-root flour have any adverse effect upon the functioning of the digestive organs.

A week before the experiment ended, one of the pigs in Lot No. 2 had some sort of fit. It recovered satisfactorily, but it was considered advisable to have it killed and it was accordingly sent to the butcher.

Results.—The experiment ended on December 17, and the pigs were sent to the butcher that day. They were killed on the 18th, having been fasted since after the evening meal on the 16th. Table I gives the relevant information as to live weights, food consumed, etc. :—

TABLE I

	Lot No. 1 *Tapioca*	*Lot No.* 2 *Maize*
No. of Pigs	8	8
Total gain in live weight	1,528·3 lb.	1,517·1 lb.
Average „ „ „ „	191·04 lb.	189·64 lb.
Total dead weight	1,375·25 lb.	1,387·50 lb.
Average „ „	171·91 lb.	173·44 lb.
Carcass percentage	75·63 per cent.	76·78 per cent.
Total food consumed	6,800 lb.	6,750 lb.
Food per lb. l. wt. increase ..	4·45 lb.	4·45 lb.
Total cost of food	£32 : 9 ; 6¾	£34 : 4 ; 11¼

	Lot No. 1 Tapioca	Lot No. 2 Maize
Cost of food per lb.	1·15d.	1·22d.
Cost of food per lb. l.w.i.	5·09d.	5·52d.
Average l.w.i. per pig per day ..	1·36 lb.	1·35 lb.

The gains in live weight ranged in Lot No. 1 from 156 lb. to 206 lb.; and in Lot No. 2 from 159 lb. to 226 lb. The dressing percentages showed ranges from 74·23 to 77·09 in Lot No. 1, and from 72·06 to 78·46 in Lot No. 2.

Through the courtesy of the Isle of Man Butchers' Association, reports were furnished on the carcasses of the two lots. The unanimous finding of the three members of the Association who killed the pigs was that there was nothing to differentiate those fed on the tapioca ration from those fed on the maize meal ration.

The pigs were sold on the basis of their dead weight, at the current rate of 10½d. per lb. It is the practice in the Isle of Man to exclude the weight of the head when buying pigs on a dead-weight basis, but the dressing percentages shown above are for the complete carcass. At the beginning of the experiment, the pigs were valued by two independent valuers, and the financial aspect of the feeding is shown in Table II.

TABLE II

	Lot No. 1 Tapioca	Lot No. 2 Maize
Valuation at July 30	£14 : 8 : 0	£15 : 0 : 0
Cost of food consumed	32 : 9 : 6¾	34 : 4 : 11½
Gross return at 10½d. lb. dead weight	55 : 9 : 6	55 : 11 : 2½
Net return	8 : 11 : 11¼	6 : 6 : 3½
Net return per pig	1 : 1 : 6	0 : 15 : 9¼

No charge has been made for rent, rates, taxes or labour, but on the other hand nothing has been deducted for the manurial values of the different feeding stuffs.

Discussion of Results.—The average rate of live weight increase was satisfactory with both the tapioca and the maize groups. There is a very slight difference in favour of Lot No. 1, but certainly not sufficient to warrant any assumption that tapioca-root flour is superior to maize meal in a ration for fattening pigs. Again, there is but little difference in the amount of food required in each case to produce one pound of live weight increase. A slightly lower average gain in live weight in the case of the maize meal lot is compensated for by an improved dressing percentage in the carcass. The outstanding feature of the experiment was the reduction in costs effected by the use of tapioca-root flour in place of maize meal. The cost of the food per lb. is 0·07d. lower in the case

of the tapioca ration, but the cost of producing one pound of live weight increase is practically ½d. less than with maize meal. The tapioca pigs showed a higher profit for feeding than the maize lot, by almost 5s. 9d. per pig.

SECOND EXPERIMENT

With the idea of noting the extent to which the results indicated during the early stages of the first experiment could be considered reliable, a second trial was started on September 20, 1929.

Livestock.—Thirteen pigs, eight weeks old, were available. Seven were the progeny of a Large White sow and six were out of a Large White gilt. The sire of both lots was the same Large White boar as in the case of the pigs used in the first experiment. They were divided into two lots, as before. The first group, which was given the tapioca ration, contained six pigs, while there were seven in Group No. 2, the maize meal lot. The average weight of the pigs in Lot No. 1 was 23·8 lb., and, in Lot No. 2, 23 lb.

Rations.—The scheme of feeding was the same as for the first experiment, except that, when the pigs were 12 weeks old, 10 per cent. of crushed oats was introduced and continued to the end of the feeding period; palm kernel cake meal was not fed at all. The final ration was :—

	Lot No. 1 per cent.	Lot No. 2 per cent.
Sharps	30	30
Barley meal	35	35
Crushed oats	10	10
Tapioca root flour	25	—
Maize meal	—	25

General Management.—The housing and method of rationing were the same as in the first experiment.

Pig No. 13 in Lot No. 1 developed a rupture towards the end of October, and had to be removed from the experiment.

Results.—The experiment ended on February 11, 1930. The pigs were weighed before the morning feed on the last three days, and the averages of these were taken to be the final weights. On this occasion, the pigs were sold live by public auction, with the exception of two, one from each lot, which, as formerly, were sold on a dead-weight basis. Table III shows the various results obtained.

TABLE III

	Lot No. 1 *Tapioca*	*Lot No.* 2 *Maize*
No. of Pigs	5	7
Total gain in live weight	910·0 lb.	1195·0 lb.
Average gain in live weight ..	182·0 lb.	170·7 lb.
Total food consumed	3,919·0 lb.	4,800·0 lb.
Food per lb. of live weight increase	4·3 lb.	4·02 lb.
Total cost of food	£18 : 7 : 5¼	£24 : 0 : 6
Cost of food per lb.	1·13d.	1·20d.
Cost of food per lb. of l.w.i. ..	4·85d.	4·83d.
Average l.w.i. per pig per day ..	1·27 lb.	1·19 lb.

Discussion of Results.—These results agree with those obtained in the first experiment in at least two particulars: (1) with maize at £12 5s. per ton, and tapioca-root flour at £9 5s., the substitution of the latter for the former cheapened the cost of food per lb. by 0·07d.; (2) the average rate of live weight increase with tapioca was very similar to that with maize. Actually, in the second trial, it was slightly better, but the difference was too small for any significance to be attached to it.

The tapioca pigs made a larger gain in live weight per pig by some 12 lb., but on the other hand they consumed rather more food per lb. of live weight increase than those fed on maize meal.

The pigs in this second experiment did not thrive as well as those in the first trial, but there was nothing to indicate that the tapioca-root flour had an adverse effect on either the rate of growth or on the health of the animals.

Conclusions.—From the foregoing experiments it is permissible to infer:—

(1) That high-grade tapioca-root flour has proved satisfactory as far as its palatability and its effect on the digestive organs are concerned.

(2) That, in a ration for fattening pigs, it may replace maize meal up to at least 25 per cent. of the total ration.

(3) That the quality of the carcass is not affected adversely by the feeding of tapioca-root flour to the extent indicated.

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COUNCIL OF AGRICULTURE FOR ENGLAND

THE Thirty-Fourth Meeting of the Council was held at the Middlesex Guildhall, Westminster, on Friday, October 31, *Mr. Denton Woodhead* being in the Chair. The Chairman offered the Council's congratulations to Sir George Edwards on the honour of Knighthood which had been conferred upon him since the last meeting of the Council (May 30, 1930). *Sir George Edwards* replied with a short speech of thanks. The Chairman then welcomed Dr. Addison, M.P., on his first appearance at the Council as Minister of Agriculture; also Lord De La Warr on his appointment as Parliamentary Secretary. He added that he was glad that the Minister had been able to insert legislation dealing with the scrub bull in the list of items of the Government's agricultural policy. The subject was one which the Council had taken up strongly and on several occasions had impressed upon previous Ministers.

The Minister thanked the Chairman, saying he was assured that the Council concerned itself with constructive criticism rather than with the other kind, and that it was determined to deal with agriculture in a non-party spirit. He hoped to make a beginning in introducing the Government's proposals in a few days' time. There was a likelihood of three main Bills. The Scrub Bull Bill would be introduced into the House of Lords almost at once. He thought that the measure was essential to the welfare of British live stock. As to the other measures, he asked members to do all they could to assist the Government. There was nothing in the Land Settlement Bill of which anyone need be afraid. The Marketing Bill was on the agenda with various other items for to-day's meeting.

Agricultural Marketing Bill.—*Sir Arthur Hazlerigg, Bart.* (Leicester), Chairman of the Standing Committee, moved the adoption of the Committee's Report on the Agricultural Marketing Bill.* First of all, he wished to tender the Committee's best thanks for the painstaking way in which officials of the Ministry had explained the Bill to the Committee and answered all its questions. There was divergence of political views amongst members both on the Council and on the Standing Committee, but he thought that the Committee had managed, notwithstanding, to produce a unanimous Report. Broadly speaking, it supported the Bill. Under the Bill, the

* See Appendix, page 901.

individual farmer would not be in danger even if he were subjected to compulsion. The Standing Committee had found that farmers needed more organization in marketing, and this the Bill proposed to give in a way which, while compelling a reluctant minority, would be fair to the industry. The Committee had had before them representatives of certain Dominion Governments, and also the benefit of discussing with them the lines of the new marketing proposals. In this connexion, there was one word of warning he wished to utter. It was dangerous to argue that because a scheme had been a success or failure in some other part of the globe that it must be a success or failure in this country. The main factors were often entirely different.

The condition which the Committee attached to their recommendation of the Bill was that some control of imports was necessary from countries where costs of production were lower than in this country, or where subsidies or veiled subsidies were paid. Such competition was unfair, and agriculture should be guarded against it. As to the kind of protective measures, that was a matter which the Committee left to the Government.

The Rt. Hon. Sir Francis Acland, Bart., said he wondered whether any free trader who voted for this Report could properly count as a free trader any longer. He was one, and while admitting that, as a member of the Standing Committee, the Committee had given most cordial consideration to his suggestions, there were certain words at the end of paragraph 4 to which he could not possibly agree. These words were "where the costs of production are lower than in this country." If these words were retained, the Report would mean that steps would have to be taken to deal with wheat coming from India or from the Argentine; with many things coming from any European country or from Ireland; and with wheat from Canada, where the cost of production was less than in this country. The principle would apply also to timber. He could not agree that the importation of timber should be licensed, or home supplies protected. If we could not compete in our own markets with ordinary supplies from Belgium, Denmark, Argentina, India, Canada and Ireland, he would rather give up agriculture altogether than have the industry supported at the general public expense. He thought the Government could and should deal with "dumping" in its strictly proper sense. If the Report went further and raised expectations of considerable State help by means of

general protection, the Marketing Bill would fail because farmers would not trouble to work it.

Mr. Chas. Roberts (*Cumb*) said he would like to support Sir Francis Acland on the plea that the Council should discuss the Marketing Bill for itself, and not slide away into what are called its "necessary complements." The Bill was a very important measure with new features in legislation, and it would not be very easy to get it through. Adding further burdens to it, would not help. The merits of the Bill were very real; firstly, the Government gave a power which might lead farmers away from their engrained traditions of individualism, and, secondly, the Bill did give a chance of the producer getting more of the final price of his goods for himself. The "necessary complements" to these advantages were in the Bill itself, namely, the power of dealing with surpluses. At the present time, the National Farmers' Union stated the price of milk, and the retailer fixed it. Under the Bill, the surplus would be taken off the market and manufactured by a producers' board, and a better price for the bulk of the commodity would be secured. His enthusiasm for Protection was damped by the recollection that general elections were bound to come along, and with six urban electors to one rural elector there seemed very little chance of an abiding state for that policy.

Mr. J. Hamilton (*Lancs*) suggested an alteration in the Report to meet Sir Francis Acland's difficulty.

Mr. John Beard said that "the costs of production" was an unsafe and unsatisfactory phrase, and he suggested that the word "wages" be inserted instead. He was neither a free trader nor a tariff reformer, and had not learned to subscribe to the cry of cheap food, knowing that it had to come out of the bones of men who were not getting wages enough to pay for their ordinary daily sustenance. What would be the reply if the country were told that cheap boots or cheap clothes were essential; what would the Trade Unions say? He objected to the same talk about cheap food.

Mr. R. G. Patterson, O.B.E. (*Staffs*), reminded the Council of the cause of all recent marketing measures, namely, the enormous difference between the price paid to the producer and that received from the consumer. The Marketing Bill aimed at a solution in favour of the over-pressed producer without imposing hardship on the consumer. At the same time, there would be extraordinary difficulties in the way of carrying the measure into effect. He thought the Government must have

realized in presenting the Bill that some control of imports was necessary. The Government might say, "If you, the agricultural community, are prepared to do your best to welcome the Marketing Bill, we, on our side, are prepared to introduce legislation to make it possible for you to work this Bill." At the moment, the community had no assurance that this was the Government's view. He then asked one or two questions as to detail, *e.g.*, how district boards would work as between one another with such a commodity as milk. He foresaw that an enormous staff would be required to regulate the supplies of milk which each individual must produce, or to keep records of that milk. The Bill would take some considerable time before it was of any great advantage to the agriculturist, and, in view of the dire state of agriculture, he wondered what would happen to them in the meantime.

Sir Arthur Hazlerigg intervened to say that as Chairman of the Standing Committee he was prepared to accept the substitution of "wages" in the place of "costs of production."

Mr. W. B. Taylor (*Norfolk*) congratulated the Standing Committee on its excellent Report and did not agree that the debate should be confined to the Bill itself. The debate was on the Standing Committee's Report, and the Committee would no doubt welcome any constructive criticism upon it. He was glad to hear Sir Arthur Hazlerigg's decision. He viewed with considerable surprise the statement of Sir Francis Acland that the policy recommended by the Standing Committee would mean that agriculturists were asking to be permanently supported at the public expense. Anyone studying the history of agriculture in this country would readily agree that the countryside had been bled white to the benefit of the urban population, and that the public had really lived at the expense of the countryman on the principle of the dole. Only the countryman had had to take less than the dole, whilst others got away with the middlemen profits and had benefited in other ways where they toiled not neither did they spin, but the schemer scored and the worker lost every time. He was sorry to have to speak so bluntly, but he came from a county where the farmers were disgusted with political matters and were setting up what was called the "Norfolk Movement" to solve their difficulties. This Council was a classless organization representing the whole industry. He welcomed the alteration in the Report as one made in the right spirit of the Council.

Mr. H. W. Thomas (*Hants*) said that as a farmer of over 40 years' experience he thought the Marketing Bill, unless accompanied by some control of imports, would be of little use to agriculture. The same view was held by the National Farmers' Union. Another point was that the Bill threatened gross restriction on personal liberty. Farmers were restricted at present, having to pay a fixed wage and fixed tithe, and if the Bill established methods of sale without improving prices, more harm than good would be done by it to the industry.

The Minister of Agriculture thanked the Council for the discussion. The Bill was perhaps a difficult one to follow, as wording was always at the dictates of the lawyers. In the case of milk, which had been mentioned, the price paid to the farmer was not kept down by importations. The chief feature in its marketing at the present time was the almost complete disorganization of the producers and the existence at the same time of an undealt-with surplus. The position did not relate in any way to the age-long controversy of protection or free trade. Processing and dealing with surpluses of all kinds of agricultural produce would be more fully dealt with in the Bill in its next revised form. As regards the farmers' boards, there were two types referred to in the Bill, namely, that which would actually deal with the commodity physically, holding it and marketing it, and that which would act as a sort of regulating pool only. The two types were necessary because of the diversity of the products in agriculture. As to milk, again, that commodity would be one for the regulating type of board, and he hoped that the large distributing combines would be willing to come to working arrangements with a national milk-producers' board in the business of disposing of the product. The Bill made provision for the exemption of what might be called the "local supplier." It would be quite absurd to produce a scheme whereby a farmer could not readily supply his neighbours in the village with milk. The producer-retailer might also be a reasonable exception, and there might be others. As an example of a district board, there were commodities like Cheshire cheese.

The Bill was designed to enable producers to combine for better marketing, but it did not give a guaranteed market; that was an impossibility except with complete socialization of supplies; and prices could not be governed until there was an organization of producers competent to handle their products in a comprehensive way, to collect, grade, and

distribute, and to promote the formation of processing plants or factories. It was only possible to help the farming community to help itself in the face of the extremely powerful middle agents. He believed that the real distributors would welcome the provision of commodities in a more organized and disciplined way, and he thought it was only possible to attain that by means of the Bill.

As regards compulsion, in Yorkshire only recently the following was the case with a bacon factory with 1,500 members which was designed to operate upon 1,000 pigs a week. When prices were good the pigs were there, but when they had fallen the farmers were tempted away to sell their animals privately instead of to the factory, and now only about 400 pigs a week were forthcoming. He thought it would be to the good of all the farmers if there were pressure behind those who backed away from their moral obligation to support the factory.

The Minister added that both he and his colleague, Lord De La Warr, were extraordinarily cheered by the critical examination which the Council had given to the Bill, and its commendation of it. An amended form of the Bill would shortly be forthcoming, and any further suggestions from the Council would be welcome.

The Chairman then put it to the meeting that the Report be adopted, the word "wages" being substituted in place of "costs of production" in paragraph 4. The alteration was agreed and the Report adopted.

Insecticides and Fungicides.—*Mr. Cecil Robinson* (*Holland, Lincs*) moved the following resolution on behalf of the Standing Committee :—

> That this Council considers that legislation should be passed as soon as possible to provide that insecticides and fungicides sold for agricultural purposes be made subject to similar regulations to those imposed in the case of sheep dips under the Sheep Scab Order, or of fertilizers and feeding stuffs under the Fertilizers and Feeding Stuffs Act of 1926 ; *i.e.*, it should be made possible to compel sellers of insecticides and fungicides to give a declaration that they reach the necessary effective strength.

The motion was seconded by *Mr. J. T. Briggs* (*Soke of Peterborough*). *Mr. Robinson* said that thousands of pounds were spent every year in fungicides in his county for spraying potatoes and celery. The market price of the chief one was about £30 a ton, and it should be up to a certain strength. A mixture at £25 a ton was being offered which, when analysed, was found

to be very inferior. He thought that many farmers and smallholders were paying double the price they should for their fungicides. *Sir Douglas Newton, K.B.E., M.P.* (*Cambs.*), agreed and said he thought that the legislation would not be very controversial. He understood that the proposal had the support of Gloucestershire and Herefordshire, and would probably receive that of other county agricultural authorities if brought to their attention. Dry spraying was not always successful, though it could be if two conditions were observed. First, it must be properly carried out, and, secondly, the proper material must be used. *Mr. Briggs* pointed out that regulations would be useful, as in the case where a farmer wanted credit. It might not always then be easy for him to get a sample analysed before he bought. *Sir Merrik Burrell, Bart., C.B.E.* (*West Sussex*), said that it might be possible for the Ministry to draw up a schedule of approved insecticides and fungicides on the same lines as they had drawn up a list of Sheep Scab dips.

Earl De La Warr, replying on behalf of the Ministry, said that the Department was anxious to encourage the wide use of spraying operations against insect and fungus pests. A Bill would be required for the purpose of the resolution, and it would not be entirely non-controversial ; there might, therefore, not be any parliamentary time available. The Report of a Committee appointed to consider the Bill of 1921 had just been published. If those interested in the subject would consult with the Ministry, it might be possible to make the existing Bill non-controversial, and the Ministry would then be very glad to go forward with the matter.

The Resolution was put to the Meeting and carried.

Agricultural Policy.—*Mr. W. W. Sampson* (*Dorset*) moved :

> That this Council, recognizing the ruinous condition of the agricultural industry, respectfully advises His Majesty's Government immediately to confer with the Leaders of the Opposition, with a view to agreeing to a policy for the relief of the present distress, and further each and every member of this Council pledges themselves severally and collectively to assist the Government in carrying such a policy into effect, regardless of party politics.

Mr. J. Hamilton seconded. *Mr. Sampson* drew attention to the fact that since the repeal of the Corn Production Act there had been a decrease of nearly two million acres under the plough, and of 130,000 agricultural workers ; in addition, it had been stated that there were at the present moment a very large number of agricultural workers unemployed. He

had said at the last meeting that the industry was in a ruinous state; such figures as these proved his statement. He acknowledged that the sugar-beet subsidy had been a great help. Advice was the other thing that was given, and that seemed to him to have led to over-production in certain directions, *e.g.*, milk. The Minister had said that milk was not affected by imports. What then was the significance of the condensed milk importation, the equivalent in raw milk of the 1929 importation being 81½ million gallons? The resolution was purely a matter of procedure. He had been careful not to introduce any question of policy. He realized that he was now addressing members of the three political parties, and also members of the agricultural workers and land-owners' organizations. He realized that all of them could deal with agriculture without any political or party feeling. There had to be willingness on both sides, and he therefore suggested his resolution as leading the way to agreement so that the industry might be saved from disaster.

Major F. H. Fawkes (*West Riding*) pointed out that the fact that condensed milk the equivalent of 81½ million gallons was coming into the country was a strong argument in favour of the adoption of the Marketing Bill. The example of Sweden, Denmark and Holland showed that where by-products could be dealt with efficiently and despatched abroad it was a great advantage to the dairy industry. He suggested that these by-products should, in the case of this country, be manufactured into condensed milk here and save the need of imports.

Sir G. L. Courthope, K.B.E., M.P. (*East Sussex*), said he hoped that the Council would not be so foolish as to pass the resolution proposed. The Council should not saddle itself with such a resolution, the trouble being not party politics but rival sub-divisions of the industry seeking for their own profit. Rural interests were largely outnumbered by urban interests; and in the rural industry there was nothing approaching agreement. If that industry could be united in a statement of its wants, that would be a big advance. It should also be remembered that agriculture was not the only industry that was depressed and stood in need of assistance.

Mr. Patterson stressed the fact that agriculture was the foundation of all other industries, and that though others may be suffering it seemed essential for the national benefit to place agriculture on a sound and profitable basis. This also would be in agreement with the recent pronouncements

of all Parties. Wages were fixed and he knew at the moment of 12 men whose services on a farm were being dispensed with. His own dilemma was whether to give up farming altogether, or to turn his farm largely down into grass. The coal industry appeared to be entitled to a living wage at the expense of the taxpayer—surely agriculture was also entitled to it. He had spoken as regards the Marketing Bill, but he now wished to say something about the new proposals for small-holdings. He did not think that these could be increased unless by subsidies. The small-holder to-day was living on subsidies.

The Minister informed the Council that before the Recess an attempt was made to bring the different Parties together in consultation in this matter, but that no progress was made. He need not now go into the reasons, but the proposal did not commend itself to them. After all, some subjects were so complex and so big that the principles of different sides did not lead them to formulate a united policy. He was glad to feel that there was as much co-operation at present as seemed to be possible.

The resolution was put to the meeting and carried by 25 votes to 22.

Protection from "Dumped" Produce.—*Mr. H. T. Cox* (*Herts*) moved—

> That faced with the gravest crisis known to any living agriculturist, and with a full sense of its responsibility and position, this Council does most urgently call upon the Government, in the interests of the agricultural community and of the whole nation, to take immediate and active steps to prevent further dumping of Russian and foreign bounty-fed wheat and other food products, which is even now resulting in more and more farm workers being forced out of employment, numbers of small-holders failing, farmers and land owners rapidly being forced into bankruptcy, and land lying derelict.

Mr. S. Wallace (*Herts*) seconded the Resolution. *Mr. Cox* said, as regards the Russian wheat importation, that some little time ago he had been asked to collect for the Red Cross Societies in this country for a fund for starving Russians. Either that was wrong then or the Russian Government was wrong now by taking wheat for export from these starving Russian peasants. He left it to the Council to form its own opinion. In agriculture, there should be as high a standard of living as in any other industry. In the industry to-day it was difficult to make the money to pay out the wages on Friday night. Then, again, in ordinary industry, workers could be dispensed with in bad times, but it was quite a different thing considering the close personal

relations between most farmers and their men. The co-operative societies were the first people to deal in Russian wheat, though they were started in order to help the working man. Was there good sense in helping the working man of Russia by starving the working man of this country? The Government's scheme for settlement, small-holdings, etc., was at odds with the policy which allowed men who really knew the job to be driven off the land. It would be better to give half the proposed money to keep the present people in farming. If wheat-growing could be made profitable, all other branches of agriculture would fall into line. *Mr. A. E. Bryant* (*Bucks*) said that farmers were losing their best men; the old men were staying on, but the young men were not content with 30s. or 31s. a week. It was a very serious matter to delay bringing prosperity to agriculture. He himself employed 25 men, and wanted to see the time come when he could pay these highly skilled workers £3 a week. He did not see the use of the Council meeting to discuss matters, while this sort of thing was allowed to continue. *Mr. G. G. Rea, C.B.E.* (*Northumberland*), suggested that the resolution should be amended by the substitution of the word "cereals" for the word "wheat." The mover and seconder of the resolution agreed. *Mr. W. Holmes* drew attention to a memorandum of the East Sussex Farmers' Union on the question of imports of cereals and food-stuffs. Out of 225 farmers in that Union, 12 only sold more cereals than they bought. The majority were glad to buy food-stuffs cheap in order to turn them into pig and other products. As regards oats, he was speaking a few weeks ago in a Gloucestershire village where the farmers sold their own oats to the racehorse proprietor and bought German oats for their own stock. The racehorse owners were now following suit, and it seemed to him in everybody's interest to buy the cheapest they possibly could. As regards "dumping," he was not in favour of it, but after all someone in this country must be buying Russian cereals for them to be "dumped." He suggested it was in many cases farmers themselves.

The resolution was then put to the meeting, the word "cereals" being substituted for "wheat." The resolution was adopted.

Prosecutions under the Fertilizers and Feeding Stuffs Act, 1926.—*Mr. A. E. Bryant* (*Bucks*) moved—

That in order to secure an effective and economical administration of the Fertilizers and Feeding Stuffs Act, 1926, the Minister of Agriculture and Fisheries be urged to take steps to amend the Act in order to restore to local authorities power to institute criminal proceedings in respect of adulterated samples taken on the premises of the purchaser; on the ground that the present Act is not economical in administration and affords the minimum amount of protection to the farmer.

It was duly seconded. *Mr. Bryant* said that, as a result of the recommendations of the Departmental Committee on the Fertilizers and Feeding Stuffs Acts, amending legislation was passed which altered the method of taking proceedings. It was submitted that the change of procedure in the case of samples taken by inspectors of local authorities on the premises of the purchaser, by which such samples cannot be made the subject of criminal proceedings if found adulterated, did not tend to increase the efficiency of the new Act. These principles might be ideal if everyone, trader or manufacturer, were honest, but experience in Bucks had shown that such was not always the case. To prosecute successfully under the new Act, it was necessary that the sample should be taken on the premises from goods prepared, or consignments ready, or exposed for sale. In the case of the purchasers being under another local authority, one inspector had to pass information on to another, and by the time the latter arrived at the factory to take his sample on the premises he failed to find anything that would not satisfy the Act, or there was no such article prepared for sale. *Sir Charles Howell Thomas, K.C.B.*, speaking on behalf of the Ministry, reminded the Council that the Act of 1926 was produced as a result of careful consideration by the Committee presided over by Lord Clinton, and that this question of proceedings was specially considered by that Committee and the Act framed according to their finding. He suggested that it would be best to have a further trial before the step now contemplated was taken, as the matter was by no means as simple as might appear. The resolution was put to the meeting, and 12 voted for it and 12 against. The Resolution was not carried.

APPENDIX

REPORT FROM THE STANDING COMMITTEE OF THE COUNCIL OF AGRICULTURE

AGRICULTURAL MARKETING BILL

(1) The Committee has, over a period of three years, given special attention to the question of the improvement of agricultural marketing in this country. It has issued twelve Reports on the marketing of specific commodities, nearly all of which have been printed and circulated throughout the counties.

(2) It appears to the Committee that the Bill is a logical development of policy in sequence with the provisions of the Agricultural Produce (Grading and Marking) Act of 1928. It is known to those

who have studied the marketing situation in this country and in certain of our Dominions that a measure of compulsion on outstanding minorities of producers has been deemed necessary in several instances where producers endeavouring to sell co-operatively or to take joint action to regulate marketing on up-to-date lines have been frustrated or discouraged by the action of a small number of individualist sellers. Moreover, it is the fact, where a commodity is to be sold in a free market and there is a prospect of growers over-stocking the market and upsetting a fair price, that no one seriously doubts the advisability of producers combining for the purpose of orderly marketing, on some such lines as those indicated in the Bill. The selling pool or other organization to be effective should, in fairness, embrace all producers of the commodity to be marketed. The Bill does not, however, impose anything on producers, except on the initiative of groups substantially representative of those who produce the product to be dealt with in the area to which a scheme applies. The measure, therefore, is entirely optional on groups of farmers and the legislation may be said to provide means, which farmers may adopt or not as they choose, to help them to market their produce efficiently. There is nothing in the Bill to prevent commodities being dealt with in national rather than local schemes, and arrangements would no doubt be made for correlation of effort among local boards dealing with the same product.

(3) Instancing three commodities—milk, potatoes and hops—in which the country may be said to be largely self-sufficing, it is the case that in each of these in recent years there has been serious trouble through the home production being uncontrolled and in excess of direct consumption. There has been a lack of central organization to indicate what quantities can safely be supplied for the home market, to decide what price should be asked for the produce available for sale having regard to the costs of production and the demand for it, and, in the case of milk and potatoes, to deal with surpluses and to undertake much-needed publicity on an adequate scale. The provisions of the Bill would be most useful in such cases.

(4) If the Bill would be useful in instances where competition from abroad is not very pronounced, the need for it is probably even stronger with regard to those commodities in which there is overseas competition, and in which the supplies coming on to the home market may easily be extended beyond the bounds of any possible bumper home crop. But in the case of these commodities—with the addition, possibly, of potatoes in certain exceptional years—there is, it is suggested, a need for more than internal organization on the lines of the Bill, for no amount of combination for marketing or compulsion of minorities will avail where the home market is under-sold by imports of agricultural produce from countries where [costs of production*] are lower than in this country, or where subsidies, or veiled subsidies, are paid.

(5) For this reason, the Committee considers that the measure can only reach its full beneficial effect if there is coupled with it control of such imports under a scheme which will ensure that these do not undersell a fair home market. The Committee is not concerned with the methods of control, which may be by tariffs, or licences, or even State purchase of those commodities which are being "dumped" at less than their cost of production in the country of origin, or by a combination of any of these. There may be grave objections to any and all possible methods, but the present marketing position is so serious that a way should be found immediately to prevent the continual underselling of our home agricultural market by imports coming

* See reference at end of Report.

under the heads named. Certain branches of agriculture already threaten to become entirely bankrupt on account of this evil. In the case of cereals, in which the marketing position is by far the most serious, it is the fact that by the establishment of a quota system by which all millers would be required to buy a percentage of home-grown wheat in flours for bread-making, some amelioration would be secured. But a moderate quota, which it might be reasonable to impose, could hardly be effective in helping arable agriculture to pay if large quantities of overseas wheat, subsidized or deliberately marketed below cost, were allowed to be landed in this country. Even in the case of the articles in which there is a virtual monopoly, *e.g.*, milk, potatoes, and hops, the present system of non-control of food imports under any possible set of circumstances may at any time through improvement and cheapening of transport and/or cold storage permit of entry of below-cost imports which will swamp these fortuitously protected markets.

(6) If, therefore, the Bill is likely to become law at an early date, the Committee most earnestly represent that its necessary complement is a measure of imports control of the kind suggested. At the same time, we agree that the Marketing Bill can be made of considerable value to farmers in helping them to organize the marketing of those commodities in which they are not driven out of business, and that certainly the state of things it aims at establishing is an undoubted improvement on the present almost entirely unorganized condition.

(7) For the information of members of the Council, a short summary of the contents of the Bill is appended :—

Summary of Draft Bill

(8) The explanatory Memorandum printed with the Bill shows that the Bill proposes to allow producers of an agricultural product to which it applies (milk, potatoes, hops, wool, cereals, cheese, live stock) to regulate the marketing of that product by means of boards elected by themselves and in accordance with schemes submitted by themselves. Such regulation is to be confined to products grown in the area to which the scheme is applicable, which may be Great Britain or any part thereof, and the scheme will be binding on all producers of the regulated product in that area.

(9) The interests of the public and of individual producers are protected by requiring the Minister, before approving a scheme, to give notice of it and to consider any representations made, and by giving Parliament the opportunity of resolving that the scheme shall not come into force.

The interests of producers are further protected by provisions for independent arbitration and either for exemption from the scheme or for representation on the board administering it.

The interests of the general public are further protected by the establishment of a special "Consumers' Committee" for every scheme, whose duty it will be to watch, and consider complaints as to, the effect of the scheme on consumers. The Bill also establishes a "Committee of Investigation" to which the Minister may refer a complaint from a Consumers' Committee or a complaint which would not fall to be considered by a Consumers' Committee. If the Committee of Investigation report that any matter requires rectification, the Minister has power to amend or revoke the scheme, and, if necessary, to replace the board administering it by persons nominated by him. The Minister is also empowered on his own initiative to lay before Parliament the draft of an Order revoking or amending a scheme, such Order to come into force unless Parliament resolves to the contrary.

A scheme may also provide for the encouragement of agricultural research and education and may empower a board to make money advances to producers.

(10) To take the Clauses of the Bill in order :—

Clause 1 makes provisions for the submission and approval of schemes by persons who are substantially representative of those who produce the product to be dealt with in the area to which the scheme is applicable. This clause works in conjunction with the First Schedule to the Bill which prescribes rules for the submission, approval, amendment and revocation of schemes.

Clause 2 deals with the constitution of boards of representatives of registered producers which shall administer the schemes.

Clause 3 sets forth what matters a board may deal with, subject to the approval of the Minister. They may be allowed :—

(a) to buy, sell, grade, pack, store, adapt for sale, insure, advertise or transport the regulated product, to manufacture any article from that product and to sell any article so manufactured ;
(b) registered producers may be required to sell the regulated product or any kind, variety or grade thereof, only to, or through the agency of, the board ;
(c) to regulate sales of the regulated product by any registered producer by determining :—
  (i) the kind, variety or grade of the product which may be sold ;
  (ii) the quantity of the product or of any kind, variety or grade thereof which may be sold ;
  (iii) the price at, below or above which, and the terms on which, the product or any kind, variety, grade or quantity thereof may be sold ;
  (iv) the persons to, or through the agency of whom the product or any kind, variety, grade or quantity thereof may be sold ;
(d) to regulate the manner in which the regulated product is to be graded, packed, stored, adapted for sale, insured, advertised or transported by or on behalf of registered producers ;
(e) to provide for certain incidental or consequential matters, and to enable the board to encourage agricultural education and research.

Clause 4 states what miscellaneous provisions every scheme shall provide :—

(a) for requiring that no sale of the regulated product shall be made by any producer who is not either a registered producer or a person exempted from registration by or under the provisions of the scheme ;
(b) for exempting from all or any of the provisions of the scheme producers of such classes or descriptions as may be specified ;
(c) for requiring the board to recover from any of the producers who contravene the scheme such monetary penalties as may be specified ;
(d) for securing that any producer who is aggrieved by any act or omission of the board may refer the matter to arbitration ;
(e) for keeping and furnishing accounts, and for requiring estimates, returns, accounts and other information to be furnished by registered producers, and providing powers of entry and inspection, as set out in the Third Schedule of the Bill.

Clause 5 requires that every scheme shall provide for the establishment of a fund to be administered and controlled by the board, and gives the board certain powers of assessing and recovering contributions,

and for borrowing. Any scheme may also empower the board to lend any registered producer sums proportionate to his interest in the scheme. The board may issue a debenture to create in favour of a bank a floating charge on any farming stock which is vested in it, and the charge shall be registered in the same way as agricultural charges under Part II of the Agricultural Credits Act, 1928, are registered.

Clause 6 allows of the continuance of existing contracts in certain circumstances and for their proper registration.

Clause 7 provides for the appointment of consumers' committees, and a committee of investigation.

Clause 8 requires the Minister to lay an annual report before Parliament.

Clauses 9-12 relate to the provision of agricultural marketing funds. For the purpose of financing boards, £500,000 shall be paid out of moneys provided by Parliament into an English fund, and £125,000 into a Scottish fund. Out of these funds a short-term loan may be made to a board when it is first set up free of interest for two years, but must be repaid within that period unless renewed. A long-term loan may be made to a board at any time for any period, but the amount of the fund that may be immobilized in such loans is limited. Loans may only be made on the recommendation of a special committee appointed under the Bill.

Clause 13 provides that any expenses incurred by the Minister in connexion with any committee appointed under the Bill shall be defrayed out of moneys provided by Parliament. (The explanatory Memorandum states that the aggregate expenses incurred under this provision and of any additional staff which may be required by the Bill are not expected to exceed £20,000 per annum.)

Clause 14 sets out the procedure in connexion with the laying of draft Orders before Parliament, and the publication of Orders in the Gazette.

Clause 15 makes the Bill applicable to the articles named in the Fourth Schedule, viz., milk, potatoes, hops, wool, cereals, cheese, live stock.

Clause 16 is an interpretation clause.

Clause 17 sets out the modifications in applying the measure to Scotland.

Clause 18 states that the Bill shall not apply to Northern Ireland.

October 22, 1930.

[Adopted by the Council at its meeting on October 31, 1930, the word "wages" being substituted in the last sentence of paragraph four (page 902) in place of the words "costs of production."]

* * * * * *

MARKETING NOTES

A Review of the National Mark Fruit Schemes.—The application of the National Mark Scheme to fruits has now reached the third year. In view of the comprehensive and far-reaching nature of the reform undertaken, the scheme has developed far more rapidly and has met with greater support from all sections of the trade than was anticipated. Many enthusiasts, lacking knowledge of the difficulties besetting reform in the intricate processes of fruit marketing, expected the whole trade to be placed on a fully-efficient basis at once. Experience has shown them, however, that reform is a comparatively slow process which calls for faith and perseverance, together with a liberal measure of friendly co-operation between all interests concerned.

Growers.—Many growers, in the first flush of enthusiasm, expected that the application of the National Mark to their packages would bring an immediate increase of monetary return. Experience has now convinced these growers that, while the scheme secures for them the full value of their fruit, it is in the general increase in efficiency of the fruit industry, particularly in the sphere of marketing, that the major benefit lies, and that the more rapid the growth of the scheme the sooner will this benefit be received.

The value of the scheme in providing a national basis for advertising home-grown fruits is now widely realized, and this is an important factor in securing and maintaining the support of all sections of the trade.

Probably the most important effect of the scheme, so far, is the incentive which it has given to growers to strive for better quality in production. The establishment of clearly defined statutory standards of quality has revealed to many growers their failings in production methods. In the absence of standards based on the requirements of the distributive section of the trade, each grower worked to a standard which he considered to fit the circumstances, but which was often lamentably low. The National Mark Scheme has provided a real basis upon which these growers can establish their production and marketing operations, irrespective of whether they use the Mark or not. Indeed, since the inception of the National Mark Fruit Scheme, there has been an enormous improvement in the standard of production, grading and packing set by growers who are not yet using the Mark. Many state frankly that they are grading and packing to National Mark standards although not yet participating in the scheme.

Some of these growers still cling to the idea that the value of their private mark or label is paramount and think that this is lost when they join in the scheme. They fail to realize that the influence of their private brand is limited to a comparatively small circle of buyers and that expansion of this circle is slow and difficult. They cannot understand that the National Mark not only certifies the private mark but extends its usefulness.

Salesmen.—At the outset, the Ministry's staff available for propaganda work was very limited and, in consequence, the efforts of marketing officers were directed mainly towards producers and retailers. It was assumed that if growers marketed under the Mark and retailers responded with a demand for National Mark fruit, the salesmen handling it would do so efficiently whatever might be their opinions of the scheme. This assumption proved to be correct, and important salesmen have become supporters of the scheme. Recently, a more intensive propaganda among wholesale distributors has been undertaken. Funds have been provided for advertising the scheme in the fruit trade papers, and by means of a leaflet to be circulated to salesmen as well as to growers and retailers. In the advertisement and leaflet, the aims of the scheme are set forth briefly, followed by the opinions of leading growers and salesmen, together with the collective views of retailers given by their Federation and Associations. Some opinions were given in the first advertisements and in a leaflet distributed at the Imperial Fruit Show.

Retailers.—The propaganda in the retail section of the trade was intensive at the outset and has resulted in the unanimous support of the organized retailers. Many retailers expected to be able to buy full-weight National Mark graded fruit at the prices hitherto paid for short-weight ungraded lots. They bought, nevertheless, and their experience showed that National Mark packs were worth more. In the larger markets, at least, they are now prepared to pay the real value, and in the smaller markets the extension of supplies and experience will speedily bring about the same result.

Retailers have co-operated whole-heartedly with the Ministry in advertising the scheme by displaying posters.

Supplies.—In the case of all fruits in the scheme, the demand in the markets has far exceeded the supplies, but the position may be expected to improve when the propaganda referred to above has made its influence felt.

Contraventions.—In the beginning, the view was expressed

that, because of the voluntary nature of the scheme, growers electing to pack under it would endeavour to maintain the standards laid down. The small number of contraventions reported—14 in all—shows that this confidence in the goodwill and integrity of the growers was justified. In every case, the contravention was due to temporary failure in the supervision of grading and packing operatives. In all cases but two, it has been sufficient to draw the growers' attention to the cause to secure satisfactory grading. So far, there has been no suspicion of growers deliberately using the Mark as a cloak for off-grade fruit.

Supervision of Grading and Packing Operatives.—The great importance of maintaining strict supervision of grading and packing is not adequately realized by growers. Every opportunity has been taken to impress upon those authorized to apply the Mark the need for vigilance in this connexion and they have been advised to open and examine the contents of a small proportion of packages ready for dispatch from time to time. If this is done, slackness on the part of the grading and packing operatives is prevented.

National Mark Eggs.—One of the conditions governing the National Mark Egg Scheme requires that packers shall have a certain minimum weekly output. During the months of January to July, this minimum is 900 dozen eggs per week, and this is reduced, in view of seasonal decline in production, to 600 dozen per week for August and September, and 300 dozen per week for October, November and December. An encouraging feature of the returns of sales which have been rendered by packers during September—the last month for which complete figures are available—is that at a large number of stations there is little or no falling off from the quantities recorded for July, and that the total output of all stations has fallen to a slight extent only as compared with the reduction in the output qualification. This is largely due to producers increasing their laying stock.

During the 10 months, January-October, 1930, the output of the authorized packing stations amounted to 194 million eggs, of which 138 million were packed under National Mark labels.

Several important firms of egg merchants have recently taken active interest in the scheme and, in some instances, have made application for authorization.

National Mark eggs commanded very high prices during October, with beneficial effects on the English egg market

generally, but, following large imports of Dominion eggs, prices weakened somewhat, and it is now considered that this year's peak period for prices has passed.

As mentioned in the November issue of this JOURNAL (p. 813), three classes in the Egg Competition at the Dairy Show, held in October at the Royal Agricultural Hall, London, were open only to packers of National Mark eggs. The event proved a popular innovation, and was well supported by National Mark egg packers in all parts of the country. Eggs entered for each of the three classes had to be graded and packed in accordance with the requirements of the scheme. The first class was for 30-dozen, non-returnable wooden cases, containing eggs of "Standard" weight grade; the second was also for eggs of "Standard" weight grade but in 15-dozen, non-returnable fibreboard cases; and the third was for 15-dozen fibreboard containers with eggs of "Special" weight grade, packed in half-dozen or dozen cartons. A very high standard of quality was attained by competitors in each of these classes and judging was not an easy task. Silver and bronze medals were awarded in each class, the prize-winners being :—

First Class. (1) Wiltshire Egg Producers, Ltd., Hungerford.
(2) Gloucestershire Marketing Society, Ltd., Cheltenham.

Second Class. (1) Welwyn Garden City Poultry Farm, Ltd. Welwyn.
(2) E. J. Parker, Maidstone.

Third Class. (1) Vye & Son, Ramsgate.
(2) Captain F. Barber, Morecambe.

National Mark Beef.—The weekly average number of sides (including quarters and pieces expressed in terms of sides) of beef graded and marked with the National Mark during October, and the number of sides graded and marked for the four weeks ended November 22, was as follows :—

	Number of sides
LONDON	
Weekly average—October	1,925
Week ended —November 1	2,005
,, ,, — ,, 8	2,159
,, ,, — ,, 15	2,155
,, ,, — ,, 22	2,065
BIRKENHEAD	
Weekly average—October	729
Week ended —November 1	879
,, ,, — ,, 8	1,084
,, ,, — ,, 15	1,124
,, ,, — ,, 22	1,119
SCOTLAND*	
Weekly average—October	2,178
Week ended —November 1	2,079
,, ,, — ,, 8	2,049
,, ,, — ,, 15	2,131
,, ,, — ,, 22	2,217

* Sides consigned to London.

TOTAL LONDON SUPPLIES (*All sources*)	*Number of sides*
Weekly average—October	4,832
Week ended —November 1	4,963
" " — " 8	5,292
" " — " 15	5,410
" " — " 22	5,401
BIRMINGHAM	
Weekly average—October	364
Week ended —November 1	404
" " — " 8	501
" " — " 15	476
" " — " 22	486

The scheme in London continues to make satisfactory progress. The number of sides graded and marked in London and at Birkenhead during the week ended October 25 constituted a record.

An analysis of the average daily wholesale prices of beef on the London Central Market, Smithfield, during September, 1929 and 1930, shows that, whereas the prices of English and Scotch-killed beef are appreciably higher now than they were a year ago (*i.e.*, before the commencement of the National Mark Scheme), the prices of imported chilled beef have fallen considerably. There was an average increase in September last of 5d. per stone for Scotch-killed beef and 3d. per stone for English. (A difference of 4d. per stone on a medium-weight carcass of, say, 80 stone amounts to £1 6s. 8d.)

As a result of a recommendation in the Report* of the Inter-Departmental Committee on the Grading and Marking of Beef, arrangements are being made, in conjunction with the Department of Agriculture for Scotland, for the grading and marking, at Smithfield Market, London, of Scotch beef received from centres other than north-east Scotland, where grading facilities are provided at the point of despatch.

There was a substantial increase in the numbers of sides graded and marked at Birmingham during October. The weekly average number of sides is now higher than in May last—*i.e.*, before the local difficulties.

National Mark Apples and Pears.—At the Imperial Fruit Show, held at Leicester from October 24 to November 1, National Mark apple and pear packers gained some remarkable successes, and 75 per cent. of the special prizes were awarded to them, whilst in the other classes open to them they gained 60 per cent. of the total awards. Of especial interest were the entries for the "United Kingdom Championship," Class 2 (50 half-boxes of dessert apples, representing approximately

* Cmd. 3648.

½ ton of fruit) and Class 6 (50 boxes of culinary apples, representing approximately 1 ton of fruit), in which all six prizes were gained by National Mark packers. In the British Empire Class for apples (open to the Empire), the following results were recorded :—

Class 1—(10 or 25 boxes of dessert apples), first and third prizes gained by National Mark packers.

Class 2—(10 or 25 boxes of culinary apples), first, second and third prizes gained by National Mark packers.

The Second Prize-winner in Class 1 has since been enrolled in the National Mark Scheme.

The trade stands generally displayed a large proportion of National Mark packs.

National Mark Canned Fruit, Peas and Beans.—The Minister has appointed Mr. G. W. Cadbury to be an additional member of the National Mark Canned Fruit Trade Committee as representative of the canning industry.

The following firms have been added to the list of authorized canners :—

J. & J. Beulah, Ltd., Boston, Lincs.
The Lincolnshire Canners, Ltd., Boston, Lincs.

At the present time, of about 30 canners of recognized standing in the industry, no less than 16 canners, operating 21 factories, are enrolled in the Scheme. It may be said that only 2 or 3 important canners with substantial output are now operating outside the Scheme.

The experience of authorized canners, even in the brief period during which the Scheme has been operative, has been very encouraging and they appreciate the benefits accruing from the association of their produce with the Mark, which has proved a definite selling force. This fact is confirmed by representatives of the distributive trade who also pay tribute to the value of the Mark, both in wholesale and in retail trade, and comment upon the discrimination of consumers in indicating their preference for National Mark canned goods. Apart from the intrinsic merits of National Mark canned produce, the growing public demand has undoubtedly been stimulated by the wide publicity undertaken by the Ministry. There is, therefore, every reason to anticipate rapid developments in the canning industry and reports have recently come to hand of the projected erection of new factories by authorized canners in various parts of the country. This augurs well for the future, and must react beneficially to home fruit growers.

The undoubted success of the Scheme in its present limited

application encourages the idea of extension; first, to other fruits and vegetables suitable for canning and, secondly, to bottled fruits. The possibilities are being investigated by the Ministry and it is hoped that there will be developments before next season. Other questions bearing on the administration of the Scheme, *e.g.*, the standardization of containers, their weight content, etc., are also under consideration, as having a definite bearing upon the appeal of National Mark produce to the distributive trade and to the public.

Finally, the inspection of National Mark supplies, both in factories and on distributors' premises, is being undertaken, and the samples so far examined indicate that in the main the high quality standard associated with the Mark is being well maintained in this the first season of operation. It will be appreciated that this factor is essential to the maintenance of the reputation of the Mark and the future development of the Scheme.

National Mark Wheat Flour.—Representative samples of wheats from the 1930 crop, with samples of the earliest millings of flour therefrom (to National Mark standards), have been obtained from various parts of the country. The flour samples were analyzed at the Government Laboratory, and in ash content, moisture content and grade were considered to be equal to the average of similar samples from last year's crop. The wheats were found to have a slightly higher moisture content. The samples, with the analysts' reports, have been considered by the National Mark Wheat Flour Trade Committee, who formed the opinion that the flour milled from 1930 wheat would probably be superior in bread-making qualities to that milled from the 1929 crop.

The Minister has decided, with the concurrence of the Trade Committee, to modify the conditions applicable to repackers enrolled in the scheme. In future, application for enrolment may be made by any repacker who packs and sells a minimum quantity of 10 cwt. of flour per week, or who can produce evidence that during a period of six months before application he has purchased a weekly minimum of one sack (280 lb.) of National Mark flour for re-sale. It is hoped that the reduction of the minimum quantity qualification from 50 cwt. per week to 10 cwt. per week will broaden the channels of distribution of National Mark flour, especially in country districts.

National Mark Cider.—The provisional scheme for the application of the National Mark to cider made from apples

and pears grown in England and Wales has now been circulated to cider manufacturers and others interested. National Mark cider will be of two grades. Participation in the scheme is voluntary, and application for authority to apply the National Mark may be made by (*a*) manufacturers of cider (no restriction as to volume of output); (*b*) farm-makers of cider for sale whose annual output is not less than 3,000 gallons and involves the use of not less than 20 tons of apples and pears grown in England and Wales; (*c*) associations of farm-makers of cider (special rules are prescribed for such associations); and (*d*) bottlers who purchase National Mark cider in bulk from authorized makers for bottling under the National Mark and who bottle not less than 3,000 gallons of cider annually.

Copies of the scheme (Marketing Leaflet No. 22) can be obtained, free of charge, on application to the Ministry.

Publicity for National Mark Produce.—The sixteenth, and last, National Mark Week arranged for the present year was held at Cambridge from October 27 to November 1. The Ministry's display of National Mark products at the Central Hall, which created considerable interest and was visited by a large number of people, was supplemented by window displays by retailers, prizes being awarded for the best displays. Valuable assistance was rendered by the Cambridge Chamber of Commerce.

During October, the principal London stores arranged special displays of Empire goods in connexion with the Imperial Conference. Opportunity was taken to promote displays of National Mark products as part of the general Empire displays, and useful publicity was secured in this way. A photograph of one of the displays is reproduced here.

An excellent opportunity for bringing the National Mark prominently before the London public was afforded by the Lord Mayor's Show on November 10, the principal theme of which was Empire produce. The leading car in the Imperial section of the procession was an exhibit specially designed by the Ministry to illustrate the advantages of buying home-grown foodstuffs, fresh from the countryside, guaranteed as to origin and quality by the National Mark. Seated in front of the car, which was drawn by four grey horses, was the figure of Britannia. Two stalwart heralds bearing National Mark symbols constituted the advance guard. Inside the car, John Bull was at a counter indicating to a lady shopper the manifold advantages of buying the National Mark produce displayed on the car. Four attendants in rustic costumes

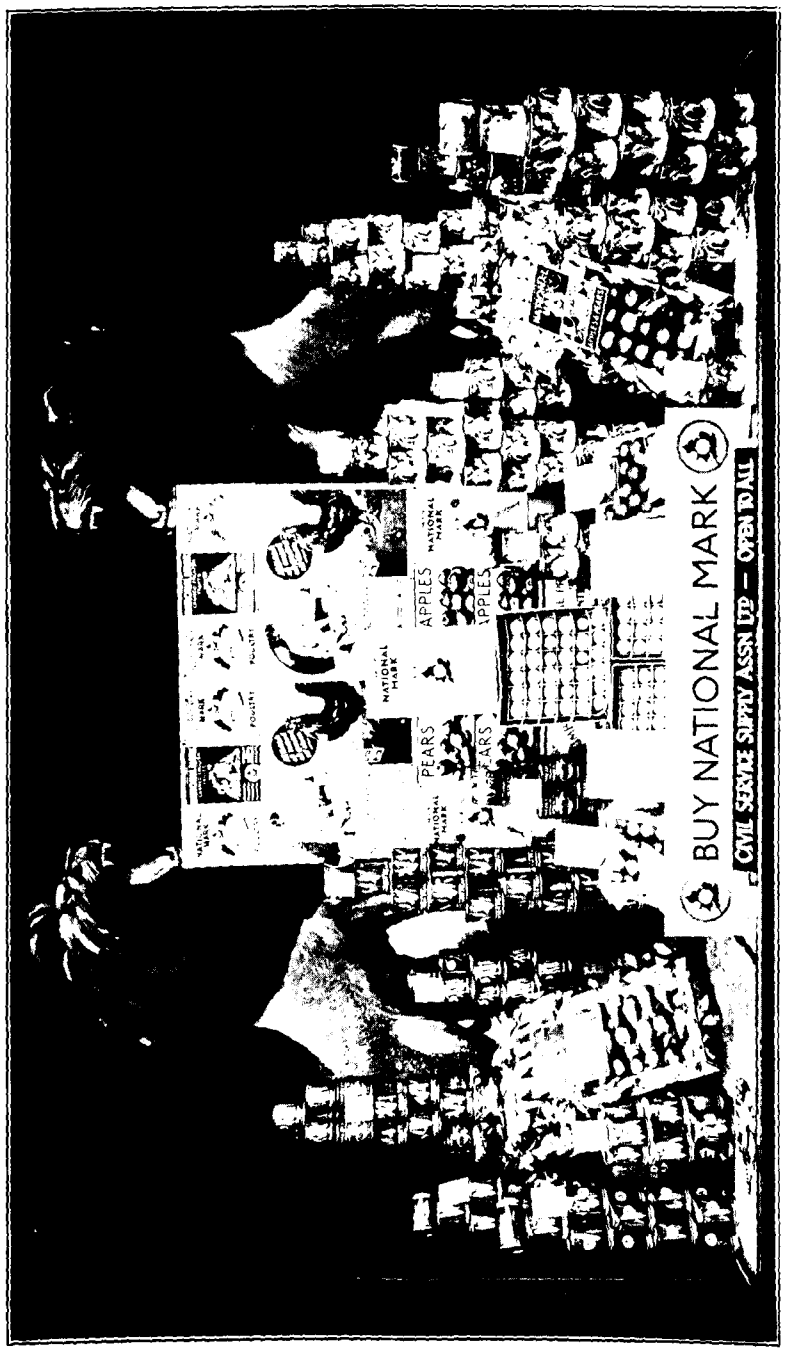
followed the car, carrying National Mark banners. Photographs of the tableau are also reproduced here.

Under the joint auspices of the National Federation of Women's Institutes and the Ministry, a National Mark Flour Cookery Competition has been arranged, open to members of Women's Institutes in England and Wales. The competition will be conducted on a county basis, each County Federation having a separate competition open to individual members of affiliated Institutes. Proficiency certificates will be awarded to competitors who attain a high degree of efficiency. Certificates will also be awarded to the three Institutes in each County Federation which secure the highest percentage of proficiency certificates in relation to total membership. Following the County competitions, which are to be completed not later than April 30, 1931, it is proposed to hold an Inter-County Cookery Competition, the entries to be scheduled and judged at the Grocers' Exhibition to be held at the Royal Agricultural Hall, London, in September next.

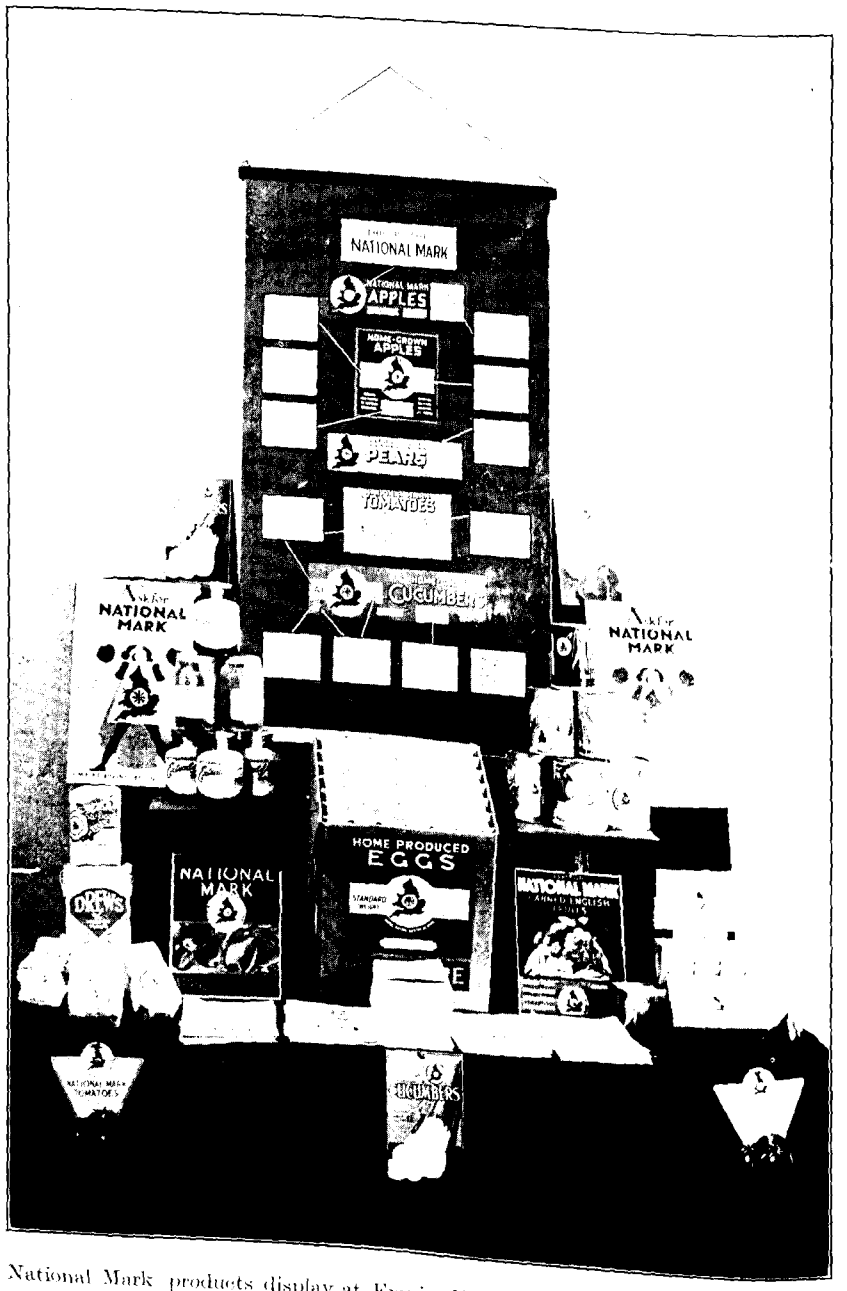
Reference was made in the November issue of this JOURNAL (p. 820) to the special lectures on the National Mark which are now being given by lecturers of the Empire Marketing Board to Women's Institutes and kindred organizations. In order to make these lectures as practical and interesting as possible, specimen packages of National Mark products with display material are shown at the Women's Institute at the time of the lecture. An illustration of the kind of display arranged is given on the inset.

In accordance with the Ministry's autumn and winter publicity programme, the advertising of National Mark products in newspapers and trade journals was commenced in October and continued throughout November. Advertising in the national and principal provincial daily newspapers calls the attention of the general public to the advantages of buying National Mark products. Special advertising in the more important newspapers circulating in the Eastern Counties is designed to appeal to farmers and other consumers in that area to buy National Mark products, especially flour, malt extract and canned fruits, and so "support local industries." Advertising in trade journals is directed mainly to producers, distributors and large users of National Mark products, *e.g.*, bakers, caterers, hotel-keepers, etc.

The advertising of National Mark beef in Birmingham newspapers was continued throughout November; this publicity was supplemented by means of addresses to women's



National Mark Produce: A window display at a London stores.



National Mark products display at Empire Marketing Board lectures at Women's Institutes.

organizations by trained women speakers, the showing of advertisement slides in cinema theatres and in various other ways. A window-dressing competition organized in four groups on a district basis, open to retailers who regularly stock National Mark beef, commenced on November 24 and will be concluded in the third week of December.

Displays of Home Produce.—In addition to the exhibit at Cambridge during the National Mark Week, referred to above, a display of National Mark products was staged in the Town Hall, Kendal, when two addresses on the National Mark Scheme were given on November 27 under the auspices of the South Westmorland Branch of the National Farmers' Union.

Marketing Demonstrations.—Demonstrations in improved methods of marketing agricultural produce were given during November at :—

Nantwich Cheese Fair	November 6	Cheese
Chester Cheese Fair	November 12	Cheese
Whitchurch Cheese Fair	November 18-19	Cheese
Stoke-on-Trent Fat Stock Show	November 26-27	Live Pigs and Bacon
Birmingham Fat Stock Show	November 29-December 4	National Mark Beef

At the Smithfield Show to be held at the Agricultural Hall, London, from December 8-12, graded live pigs and National Mark beef will be shown.

Report of the Imperial Economic Committee : Hides and Skins.—The sixteenth report of the Imperial Economic Committee,* recently issued, deals with the methods of preparing for market, and marketing in the United Kingdom, of hides and skins produced within the Empire. The Report presents a survey of the trade of the Empire in these raw materials with particular reference to the supply of this country's needs, and draws the conclusion that while the Empire as a whole produces a considerable surplus of hides and skins above the requirements of its leather industries, there would appear to be little scope for the substitution of Empire for foreign produce in the United Kingdom consumption.

In examining marketing methods in the United Kingdom and the overseas Empire, the Report particularly emphasizes the high proportion of inferior produce coming on the market, largely as a result of indifferent flaying combined with damage to the skin of the living animal by pests, such as "warbles,"

* Obtainable from H.M. Stationery Office, price 6d. net.

The National Mark Car in the London Lord Mayor's Show, 1930.

Interior of the National Mark Car in the Lord Mayor's Show, 1930.

or, in some of the Dominions, by branding. It is noted, however, that "the hides of animals killed at abattoirs in the big towns are generally of higher quality than those from private slaughter-houses. The concentration of slaughtering at properly equipped centres leads to greater care and efficiency in flaying and preparing the hide. The 'packer' hides in Canada run better than those coming from farms and country butchers; the best hides from the Argentine are those from the frigorificos; the economic value of the New Zealand calf skins has been greatly increased in recent years by concentrating slaughter at the freezing works. It seems inconceivable that the greater concentration of this work in the United Kingdom, as advocated by the Ministry of Agriculture, could have other than similar results, quite apart from the opportunities it would provide for the better sale of the offals of the animals."

The high proportion of defective hides and skins results in heavy loss to the producers, and opens the door to permanent competition from leather substitutes. With the object of improving the general level of quality, the Report emphasizes the need for better organization in the collection of hides, and for instruction of the farmer and the local butcher in the methods of preventing damage to hides either while the animal is alive or in the processes of preparation. Good work is being done in the direction of education in practically every Empire country. The Report emphasizes, for example, the excellent work done in the United Kingdom by the Hide, Leather and Allied Trades Improvement Society—a voluntary association of hide-market owners and tanners. This society, *inter alia*, has used its influence towards establishing a system of uniform grading of hides, and gives flaying demonstrations and personal instruction to slaughtermen. The recommendations of Commissions in Australia and of the Skin and Hide Industry Advisory Board in South Africa, the proposal in India for an export company to provide funds for improvements in preparation and marketing, and the intensive education undertaken by the Government in Nigeria, are also noted.

The observance of uniform grades—in which, as the Report indicates, progress is being made in this and other Empire countries—apart from its facilitation for trade, should stimulate the producer to give better attention to the condition of his product, always provided that he receives a premium for the better article. "To this end," the Report states, "purchase

by mere weight or number should be everywhere discontinued." The progress made in Nigeria, where two grades of hides, distinguished by special marks, have been established, and where exporting firms pay higher prices for the better prepared hides, is held up as an example to countries higher up the scale of economic development. In this country, the Hide Improvement Society has secured the establishment of a system of prices in the markets whereby hides free from warble are quoted at a premium. Where such premiums exist, the problem is to bring the difference in value back to the farmer. As the Report points out, "the method of organization for the achievement of this object must vary with the circumstances for each country." So far as this country is concerned, it may be added that this problem, together with others that face the live stock industries, depends largely for its solution on the development of a system of centralized slaughtering.

United States Department of Agriculture: Foreign Intelligence Service.—A statute has recently been enacted "to promote the agriculture of the United States by expanding in the foreign field the service now rendered by the United States Department of Agriculture in acquiring and diffusing useful information regarding agriculture and for other purposes." The information required is that concerned with "world competition and demand for agricultural products and the production, marketing and distribution of these products in foreign countries." The "other purposes" includes the demonstration (abroad) of standards for cotton, wheat and other American agricultural products.

Latvia: Breeding of Pigs.—An Order dated July 31, 1930, discloses that, in order to promote the breeding of pigs, the Latvian Government will pay a premium to pig breeders for pigs of certain grade standards delivered to the export slaughter-houses, such premium to be paid when sale prices for Latvian bacon in the London market fall below 86s. per cwt. The amount of premium payable is from 12s. to 16s. per pig.

The classification of the pigs killed for bacon is to be made by a committee appointed by the Minister of Agriculture and comprising the director of the slaughter-house, the master-slaughterer, and the veterinary inspector (Controller of Meat for Export), the last-named having the right of veto.

Standards for Jam.—A scheme, drawn up by the Food Manufacturers' Federation, to establish certain standards for jam, came into operation on November 1, 1930.

Two standards are prescribed, namely, "Full Fruit Standard" and "Lower Fruit Standard," for first and second quality jams, respectively.

The basis of both these standards is (*a*) a minimum percentage of soluble solids, and (*b*) a minimum fruit content for each variety of jam.

Included in the term "soluble solids" are the sugars, both added and natural to the fruit, and soluble substances present in the fruit.

With regard to the fruit content, two schedules have been drawn up for jams of the first and second categories respectively, providing in each case for a fixed minimum percentage of fruit required to be present in the finished jams.

Provision is also made for jam packed under the scheme to bear a label on which is printed the standard, whether "full" or "lower" fruit, and a guarantee that the jam conforms to the appropriate fruit standard of the Food Manufacturers' Federation. The presence of fruit juice in the lower fruit standard jams must be boldly indicated on the labels by the words "with other fruit juice" in letters of a size equal to that of the named fruit or fruits. In the case of mixed jams, where the proportions of fruit are not equal, the name of the fruit forming the larger content must appear first in the description on the label.

The regulations as to fruit content and methods of labelling also apply to fruit jellies.

Only manufacturers who have given a written undertaking to observe the standards are permitted to use the foregoing descriptions on their labels.

Economic Series (Marketing Reports).—With the issue on November 12 of the Report on the *Marketing of Dairy Produce in England and Wales, Part I—Cheese*—a review of which was included in the November issue of this JOURNAL—the Reports issued in this series now number 24. Approximately 84,000 copies of these well-known Reports have been sold and four numbers have been sold out. Several other numbers are nearly sold out (only a few copies being left of No. 5—*Co-operative Purchase of Agricultural Requisites*) and as it is not the Ministry's intention to reprint any of the Reports, those desirous of obtaining copies of any particular numbers to make up a set of the Reports would be well advised to order at once. A list of the Reports issued and about to be issued may be obtained on application to the Ministry.

DECEMBER ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,
Director of Agriculture for West Sussex.

WORK on arable land is now limited in scope. In the north, ploughing of leys for spring corn proceeds throughout the winter unless stopped by frost. Such an interference is often welcomed to allow of the carting of farmyard manure. In the south some wheat may be sown, but the principal work is the ploughing of fallows. There are too few opportunities for carting under frosty conditions; the mild winters so prevalent in the south are not unmixed blessings, and much of the arable land would benefit materially from more frequent frosts.

Grass Land.—The grass land should have attention now when few opportunities occur for useful work on arable land. Grass land is variously described, and such terms as pasture and meadow have not universal meanings. In some districts the whole of the enclosed grass is referred to as meadow land, and in others this term is confined to the grass land that is usually mown for hay, whilst that devoted to grazing is called pasture. Low-lying land adjoining rivers or streams is sometimes called brooks or holms or simply meadows. Grass in rotation is often referred to as upland pasture and the hay from it as upland hay, whereas the hay from permanent grass is referred to as meadow hay. In some districts where a fairly long rotation is practised the grass land may exist for from three to six or more years. In such cases the hay in the first and second years is often referred to as seeds hay, ryegrass hay or mixture hay, but in the later years the hay product is usually termed meadow hay.

There is also in use a considerable amount of what are described as rough grazings. These are mainly hill grazings and downland grazings on land that has never been under arable cultivation, but also includes much land that apparently was under the plough in the early years of the nineteenth century and is still being added to by land which was under the plough at a much later date. The area of land returned as rough grazings is increasing year by year, and this may be taken as indicating that a substantial area of grass land has been more or less left to natural conditions and all artificial treatment abandoned. This class of grazing is in many cases the result of neglect. Its situation and quality may be such that expensive treatment is not justified, but suitable treatment need not be expensive and might prove more remunerative

than the same expenditure on better land. Land that has been classified as under crops or grass and has drifted into the rough grazing class should be worth rescuing. The individual circumstances must be known in order to prescribe the appropriate remedy.

Deterioration may be first evident in the unpalatable nature of the herbage that is not readily eaten by stock; this rough grass is allowed to die down year after year and a matted turf is formed, accompanied by a further depreciation of the quality. Deterioration may also be accompanied by the growth of briar, bramble, thorn and other shrub growth. Molehills and anthills may also abound and the growth of bracken is not an unusual cause of trouble. Such extreme cases require reclamation at considerable capital expenditure and may not be worth it. Early deterioration should be checked.

Unpalatable grass is produced under many circumstances. The grasses may be of poor type, mechanical treatment of the land may be needed, or one or more of the essential manurial ingredients may be deficient; but very often the result is due to a combination of these causes. The first aim must be to bring about a change in the nature of the grass and render it more palatable. Manuring will usually bring about the desired change, but the conditions must be such as to give the manures a fair chance. Manures will not give satisfactory results when applied on the top of a mass of rough decaying grass; they must get into contact with the soil. The change desired is the encouragement of wild white clover, and this cannot develop unless the runners are in contact with the soil and the plant exposed to the light. Grass should be eaten off as bare as possible, and if this is not practicable without causing depreciation of the grazing stock then cultivations must be carried out. Rough grass will require drastic treatment; the disc harrow and heavy toothed harrows may be relied on to produce the necessary condition. The cultivations given are frequently not severe enough, and whilst the cure may appear drastic, the greater the need the less is the risk of damage being done by severe cultivation. Land that can be described as rough grazing is not likely to be mown for hay and consequently the loose rough material produced by the cultivations need not be carted off but can be left to rot on the ground. Cultivations alone will produce improvement, but to prevent a rapid recurrence of the same conditions manures will be required. The County Agricultural Organizer, having knowledge of the rainfall and soil conditions, should be invited to

prescribe an effective and economic method of manuring, and may be relied upon to help.

The proper consolidation of the land must also be attended to. Rolling is often abused, but opportunities should be chosen when the weather and soil conditions are suitable for compressing the soil without leaving it in a hard caked condition.

All grass land requires proper management and attention if it is to maintain full productiveness. The less suitable the land for pasture growth the more attention is required. Old established pastures on good land and carrying a mixed stock may require very little attention beyond judicious grazing, the cutting of thistles and an occasional harrowing. A few of the mistakes made in the treatment of grass land may be reviewed.

The meadow which is mown for hay year after year may deteriorate from two main causes. Mowing late in the season year after year tends to develop a particular type of herbage, usually of a coarse and innutritious nature. Late mowing may also encourage the growth of yellow rattle, a parasitic weed which, besides being useless in itself, injures the grasses. Where an extensive area of meadows is mown each year the order in which the fields are mown should be varied so as to avoid as much as possible the deterioration which results from late mowing. Another cause of deterioration in regularly mown meadows is insufficient feeding of the aftermaths. Autumn grazing is advantageous; grazing by cattle helps to consolidate the land, and close grazing gives the finer grasses and clovers a better chance, so that the tendency to coarseness which is encouraged by mowing is counteracted. A well grazed aftermath also leaves the land in suitable condition for the application of manures or for harrowing.

On average quality pastures annual treatment is important. The abundant autumn growth of grass is sometimes difficult to dispose of, and attention should be concentrated first on the fields that it is proposed to treat with manure. Land that is not in immediate need of manure may be close grazed at a later date, but some time during the winter the old grass should be cleaned off and the land well harrowed with spiked harrows. Manuring of pasture land should be practised in rotation; a good plan is to manure one-fourth each year and so distribute expenditure and labour uniformly from year to year. Such a procedure is a well tried system and may be relied on to give profitable returns and to maintain the pastures in good condition with the minimum of expense.

Intensive manuring of grass land with complete mineral manures each year, followed by repeated dressings of nitrogen during the growing season, is still on its trial, and whilst it is worthy of full investigation, and is possibly beneficial where the area of grass land available is limited, there is so much grass in need of the less frequent manuring that this should have first attention.

New Permanent Grass.—One type of grass land which has increased in late years has not been specifically mentioned. Land laid down to permanent grass not infrequently deteriorates after a few years. Frequent applications for advice are received on this subject. Much of the land now in this stage was ploughed out of grass during the war years, and having proved rather difficult under arable cultivation has been laid down again to grass or has been allowed to tumble down as soon as possible. Good land in good physical and manurial condition is usually fairly easily laid down to pasture, and instances of land tumbling down to pasture of a satisfactory character are not infrequent. Many circumstances may account for the deterioration of new pastures. The condition of the land when seeded out may have been such as to interfere with the sown seeds, the tilth having been poor, or weather conditions adverse, or the cover crop laid, or the land not free from weeds or inadequately manured. The seed mixture may have been unsuitable and the character of the grasses short-lived.

Whatever the cause, wherever deterioration of this character is severe, the remedy is not simple. Old established pastures have a basis of pasture plants to work upon and these can be fostered by suitable treatment. A worn out pasture may be so deficient in desirable pasture plants as to render the ordinary methods of improvement quite ineffective. The obvious course to pursue would be to plough the land and put it through a course of cropping and re-seed under better conditions. The cost of such a process is considerable, and if the land is not well suited for arable cropping such a procedure may not be justified. The alternative is to attempt to renovate the pasture with a suitable mixture of seed. This method is attended by risks and is not always successful. The first requirement is to get rid of as much as possible of the existing herbage and to make a tilth. Disc harrows, drag harrows or heavy-toothed harrows should be used freely. This work should be done during the winter months, but the sowing of the seed should

be delayed until early April in the south, and possibly till later in the month farther north.

A general mixture that can be recommended is 16 to 20 lb. of perennial rye-grass and 1 to 2 lb. of wild white clover. This should be harrowed in during showery weather and the land rolled when dry enough. The field should be kept free of stock and be mown over about the end of July, after which cattle may graze it without doing damage. Manuring should be undertaken either at the time of seeding or in the following autumn. Grazing in the following year is preferable to mowing.

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NOTES ON MANURES

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Chalking Experiments.—It is well known that, when land is acid, the addition of chalk or lime in sufficient quantity will produce an improvement, varying in degree according to the original shortage. On the one hand, the improvement may be relatively slight, and be reflected in more certain and uniform crops, a better state of cultivation, and greater freedom in the choice of artificial fertilizers. In other cases completely new possibilities are opened up, and crops which formerly were quite out of the question can be grown with success. In spite of this, however, experiments in chalking are far fewer than with artificial fertilizers, and such as are recorded from time to time are therefore of special interest. Recently Mr. A. W. Oldershaw* has published an account of chalking experiments on the very light, acid soil at Tunstall in Suffolk, of which many thousands of acres exist in that district. A four-course rotation of lupins, rye, roots (sugar beet and potatoes) and oats was laid down on duplicate plots. Half of each plot received chalk at the rate of 5 tons per acre in the autumn of 1926, the other half being untreated. The rotation was similarly manured with artificials on the chalked and unchalked areas, and yields for each crop of the rotation are reported for the three years following. A general picture of the results may be obtained from Table I in which the average yields per acre of the three seasons are given.

* *Jour. Roy. Agric. Soc. Eng.*, Vol. 90, 1929.

TABLE I

			Chalked	Unchalked
Rye	grain	..	29·5 cwt.	25·4 cwt.
	straw	..	47·5 ,,	42·7 ,,
Sugar beet	roots	..	10·35 tons	Failed
Potatoes		..	12·95 ,,	8·75 tons
Oats	grain	..	26·1 cwt.	25·6 cwt.
	straw	..	29·5 ,,	29·5 ,,
Lupins (1929)	grain	..	24·6 ,,	22·5 ,,

It will be seen that in the case of rye, potatoes, oats, and lupins, good crops have been obtained by the use of artificial fertilizers in conjunction with lupins ploughed in even on the acid soil. The improvement by liming was considerable in the potato crop, especially in the very dry season of 1929, for drought increases the bad effects of soil acidity. The crops in question are those which tolerate a considerable degree of acidity. Sugar beet shows quite different behaviour; without chalk the crop is a failure, the land is covered with spurrey, and only isolated and stunted plants of beet survive—a demonstration of the effects of soil acidity quite as striking as the classical example on grass at Rothamsted and on barley at Woburn.

Information relating to the growth of other crops has also been obtained. It may be summarized as in Table II.

TABLE II.—YIELDS IN 1929

			Chalked	Unchalked
Wheat	grain	..	25·6 cwt.	20·2 cwt.
Barley	grain	..	24·9 ,,	3·2 ,,
	straw	..	23·0 ,,	4·0 ,,
Lucerne hay (inoculated)			40·0 ,,	Failed

Observation plots further showed that chalking trebled the crop in the case of mustard, and that white turnips failed on the acid land, but produced a useful crop where chalk had been applied. The cost of the dressing of 5 tons of rough chalk, together with application, was estimated as 50s. per acre.

Another type of liming experiment, bringing out the effect of increasing quantities of carbonate of lime in a replicated trial carried out on modern lines, has been reported from Harper Adams College.* Applications of carbonate of lime to an acid soil on the Bunter Sandstone were made in the spring of 1928 at rates ranging from nothing to 5 tons per acre.

In 1929, barley was sown and yields were obtained as indicated in Table III.

* West Midland Province: *Advisory Chemists' Report*, 1929.

TABLE III

	Grain	Straw
No carbonate of lime ..	10·86 cwt.	10·67 cwt.
25 cwt. carbonate of lime..	17·60 ,,	15·52 ,,
50 ,, ,, ,, ..	18·67 ,,	16·55 ,,
100 ,, ,, ,, ..	20·12 ,,	19·45 ,,

The great improvement comes with the first dose, after which the further increases are small. There are, as a rule, no ill-effects following an application of liming materials in excess of the quantity actually required. Nevertheless, at a time such as the present, when outlay is being kept down to a mimimum, farmers would always welcome information as to the least quantity of chalk or lime necessary to produce the desired effect.

Further experiments on the above lines, bringing out the response of various soil types to increasing applications of lime, are needed in many parts of the country.

Magnesian Lime.—The bulk of the lime used for agricultural purposes is produced from limestone containing about 90 per cent. of carbonate of lime or from chalk of similar analysis; the resulting quicklime contains about 90 per cent. of oxide of lime. Extensive deposits of magnesian limestone occur in Nottinghamshire, Yorkshire and Durham, in situations which are convenient for agricultural purposes. These limestones contain from 3 up to 40 per cent. of magnesium carbonate according to their place of origin, and when burnt in the ordinary way they yield limes containing corresponding percentages of magnesia. The question of the suitability of magnesian limes for use on the farm has often been discussed, and cases are on record where damage has resulted from heavy applications. Experience gained in Yorkshire with these limes* leads to the conclusion that on heavy soils there is no danger if the application is limited to 3 tons per acre. On light soils poor in organic matter, and on soil already rich in magnesia, such as those derived from the magnesian limestone, they should not be employed. The magnesia has a similar action to quicklime in neutralizing soil acids—in fact weight for weight it is somewhat more effective—but it appears to remain longer in the soil in a caustic condition. The magnesian limestones when unburnt but ground to a fine powder have behaved in much the same way as ordinary limestones in American experiments conducted over an eleven-year period on a rotation of crops. There was no ill-effect

* J. A. Hanley: *Leeds Bull.* No. 107.

due to the magnesia. In districts removed from the magnesian formation the question of the use of these limes does not arise, as ordinary lime from local sources will usually be available.

Residual Effects of Fertilizers.—Experiments designed to bring out the residual effects of fertilizers are not so numerous as those in which the first year's action is ascertained. An early experiment designed to test the second-year effects of nitrogenous and of mineral fertilizers was carried out on the Broadbalk Field at Rothamsted on wheat. The manures tested were sulphate of ammonia, and "minerals"—*i.e.*, superphosphate and salts of potash—and they have been applied to certain plots in alternate years over a long period. In the year in which nitrogen was given, the residual effect of the minerals applied over previous years was ascertained, and *vice versa*. The average yields over a 74-year period are as follows :—

Years in which sulphate of ammonia (86 lb. N.) was applied (*i.e.*, residues of minerals) ..	27·7	bu.
Years in which minerals were applied (*i.e.*, residues of nitrogen)	12·5	,,
Minerals and nitrogen applied together every year	32·1	,,
Minerals only every year	11·5	,,
Nitrogen ,, ,, ...	17·8	,,

It will be seen that, on the Rothamsted soil, the residues of previous mineral manuring have been almost sufficient for the wheat, while the after-effects of a long course of nitrogenous manuring have been negligible.

The Woburn results afford similar evidence of the smallness of the residual effect of quick-acting nitrogen (41 lb. per acre) although in this case yields do not drop quite to basal level in the years when no nitrogen is given. Minerals were supplied each year, but the nitrogenous fertilizers were given in alternate years.

BUSHELS PER ACRE, 1882-96

	Wheat	*Barley*
Minerals with sulphate of ammonia applied ..	20·0	21·1
,, ,, ,, ,, omitted ..	12·3	14·7
,, ,, nitrate of soda applied ..	17·3	23·1
,, ,, ,, ,, omitted ..	8·6	14·8
,, only	7·8	10·4

Few other experiments along these lines have been reported, but a somewhat similar trial has been conducted by Professor Hendrick, at Craibstone,* in which the crop was potatoes and

* *Trans. High. Agric. Soc.*, 1926.

potash manures were in question. A series of plots had received equivalent applications of potash in seven different forms in the four years, 1921-24. In 1924, however, one section of each of the potash plots was left without potash,

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended November 12				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) .. *	9 12*d*	9 12*d*	9 12*d*	9 12*d*	12 5
Nitro-chalk (N. 15½%) .. *	9 7*d*	9 7*d*	9 7*d*	9 7*d*	12 1
Sulphate of ammonia :— Neutral (N. 20·6%) .. *	9 3*d*	9 3*d*	9 3*d*	9 3*d*	8 11
Calcium cyanamide (N. 20·6%) *	8 9*e*	8 9*e*	8 9*e*	8 9*e*	8 2
Kainit (Pot. 14%) .. .. §	3 6	2 19	2 18	3 1	4 4
Potash salts (Pot. 30%) .. §	5 3	4 18	4 18	4 15	3 2
,, (Pot 20%) .. §	3 15	3 9	3 6	3 9	3 5
Muriate of potash (Pot. 50%) §	9 10	9 3	8 16	9 1	3 7
Sulphate,, ,, (Pot. 48%) §	11 11	11 6	10 17	11 0	4 7
Basic Slag (P.A. 15¾%)‖ .. §	2 13*c*	2 3*c*	..	2 9*c*	3 1
,, (P.A. 14%)‖ .. §	2 7*c*	1 16*c*	1 16*c*	2 3*c*	3 2
,, (P.A. 11%)‖ .. §	..	1 9*c*	1 9*c*	..	..
Ground rock phosphate (P.A. 26-27½%)‖ .. .. .. §	2 2*a*	2 10*a*	2 5*a*	2 7*a*	1 9
Superphosphate (S.P.A.16%) §	3 11	..	3 9	3 6	4 2
,, (S.P.A.13¾%) §	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3¾%, P.A.20¼%) §	8 15	8 10	8 7	6 12	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%) .. .. §	5 17*b*	5 15*f*	5 15	4 7	..
Burnt Lump Lime .. .. §	1 5*l*	1 2*m*	1 9	1 17*h*	..
Ground Lime .. .. .. §	1 12*l*	1 8*m*	..	1 12*h*	..
,, Limestone .. .. §	1 3*l*	1 6*g*	1 8*k*	..	..
,, Chalk .. .. .. §	..	1 6*g*	..	1 11*h*	..
Slaked Lime .. .. .. §	..	..	2 9	2 17*h*	..

Abbreviations: N.=Nitrogen; P.A.=Phosphoric Acid; S.P.A.=Soluble Phosphoric Acid; Pot.=Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 80%, through standard sieve. *a* Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

g F.o.r. Knottingley. Ground limestone 100% through standard sieve.

h Carriage paid 6-ton lots London, bags included.

k In bags, f.o.r. Liverpool. Fineness 45% through standard sieve.

l Carriage paid 6-ton lots Bristol.

m Carriage paid 6-ton lots Knottingley.

but received its usual application of the other nutrients. The mean yield, in 1924, of the seven plots which had received potash since 1921 was 9·2 tons of potatoes, while the seven sections which had been deprived of their potash averaged 7·0 tons. In this case, although other evidence indicated that the soil was not highly responsive to potash, there was insufficient potash left over to grow a full crop of potatoes. That the result of three years' potash applications had been considerable, however, is brought out by comparing the yield in 1924 of the plots which had not received potash at all (4·1 tons) with those which had been deprived of potash in that year only (7·0 tons).

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NOTES ON FEEDING STUFFS

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Dry Cows.—Last month's notes were devoted to a description of two aspects of the question as to how long cows should be dry between lactations. The dry period gives them a chance to redress the adverse balance of food materials during the previous lactation and to put up stores in preparation for the next; it also allows the gland a fair chance for recuperation and renewal for the approaching period of activity. Neither process is properly understood, but it would seem that the progress of the former can be greatly accelerated by high feeding during the closing stages of the previous lactation and while the cow is dry; nevertheless, even with the most thorough "steaming up," the latter will always necessitate an interval of inactivity between milking periods, and appears to need 6 weeks, or thereabouts, for its full completion.

The few figures given last month show how large is the effect of the rest period on the next lactation yield, and how serious are the losses that are occasioned by failure to keep its length closer to what is admittedly the optimum—6 to 8 weeks. The figures given were for cows approaching maturity—with young ones the effect is much greater still. The first dry period (in the accepted sense) that a cow gets is between her first and second lactations, and the effect of this is very much more marked than that of rests later in life. A mature cow will suffer a reduction of about 14 per cent. if allowed no rest, whereas the corresponding figure for second calvers is no less than 25 per cent. This is a serious matter; when it is pointed out that this means that she will give only 600

gallons in place of 800 gallons if she had been dry for six weeks no further emphasis is needed. The really calamitous part of the story lies in the fact that in practice it is just these second calvers that are the ones to miss their rightful amount of rest.

This state of affairs is not fortuitous, as there are two factors that tend to bring it about. The first is the very decided tendency that heifers exhibit to long lactation in their first milking period—leading, of course, to a shorter dry period after it. The second is the belief held by some dairy farmers that the long lactation habit should be ingrained during the first lactation, which induces them to keep on milking heifers longer than they would an older cow. There is no evidence that there is anything in this belief, and it is certain that the end result of milking heifers practically right up to their second calving is very detrimental to their subsequent performances. Indeed, it does the cow a permanent injury, for a long rest next time will have little or no effect in making up for lost ground.

The explanation of the difference between second calvers and older cows very probably lies in the question of growth—and, in particular, of growth of the udder. The growth of this gland throughout life occurs in a series of waves; after a minor development in early life, the first large increase is during the first pregnancy, and this is followed by progressively smaller increases with every succeeding pregnancy. For the full development of the potentialities of the cow every chance must be given for these growth cycles to occur, and particularly the early ones as they are the most pronounced. During the first pregnancy the largest one of all has free play, but the next largest is during the second pregnancy, and this is the one that is being hampered to a serious extent by keeping heifers in milk right up to their second calving. This view carries with it the reason that this chance of development, if lost at its proper time, cannot be atoned for by long rests later in life, when the growth stimulus is dying down.

It follows from all this that the dry period is more important before the second than before the third lactation, more important before the third than the fourth, and so on. Consequently we arrive at one qualification of the 6 to 8 weeks optimum that is logical, and the rule may be stated that fairly long periods of rest are most important for second calvers, and become less important as the cow gets older.

Also, since the primary consideration with the young cow is udder growth, it is the rest itself, rather than high feeding, that is necessary. As the cow gets older the rest itself becomes less important, and, if the milk is wanted, it may be good policy to keep her milking closer up to calving time, as long as she is fed well enough to enable her to store up food materials.

Treatment as regards dry period should, therefore, be varied according to the age of the cow. There are probably any number of other distinctions that might profitably be made between individuals, for no two cows are just alike, but only one more can at present be stated. All intermediate grades exist, but it is possible to pick out the persistent milker and the non-persistent milker. The former may not go to a very high level in early lactation, but she keeps her yield up and milks on steadily with only a slow falling off for a long time; the latter, on the other hand, may run up to 5 or 6 gallons a day soon after calving, but quickly disappoints the hopes thus raised by falling away rapidly and continuously. The two types can be recognized fairly easily, and it has been shown that individual cows have their own particular characteristics in this way, and that, though persistency is largely affected by outside factors, each cow tends to keep more or less constant in this property throughout her life; she is nearly, but not quite, as constant in persistency as she is in total yield from lactation to lactation.

Persistent and non-persistent cows react very differently to the dry-period factor. The former are very severely handicapped by complete absence of rest, but gain practically nothing by further rest than about 6 weeks; taking as before 6 weeks as a standard for comparison, the very persistent second calver drops by no less than 40 per cent. if not dry at all, while a rest of a fortnight will save all but 12 per cent., and another fortnight will reduce the loss to about 4 per cent. Thus with this type of cow it is very desirable to allow a reasonable dry period; less than a fortnight will be disastrous, and the aim should be to give about a month or 6 weeks. There is, however, nothing to be gained by wasting much more time than that.

With non-persistent cows the tale is very different. The loss following no rest is in the neighbourhood of 15 per cent., and about 3 per cent. is retrieved for every week dry. The gain in this case seems to go on indefinitely—at least up to about 4 months, after which there are few instances to test

it. With this type of cow, therefore, there is a marke difference and it is a straightforward case of "the more th merrier."

If we are to indicate the practical aspect of this the con clusions must be pushed a little further, but here it behove us to tread very warily, for only the surface of the groun has been scratched. It appears probable that with th persistent milker the chief factor is growth of the gland but with the non-persistent milker it is storage of food. Th former is the dairy type, which always tends to put the foo in the pail rather than on her back, and this agrees with th conclusion drawn by Eckles some time ago, that the chie difference between the good and the bad milker is simpl that the former has the capacity for consuming large quan tities of food over and above her maintenance requirements and for using that surplus for milk production. It follow that food storage is of comparatively minor importance i her case, and all she needs is a chance to develop her udder this is a rapid process and much of it can be effected in fortnight, whilst it can be completed in 6 weeks.

The opposite type of cow is limited throughout by lac of food nutrients for the udder (her tendency being to pu them on her back), and consequently the more chance sh has to accumulate a reserve the better will be her performance The principles to be adopted in the two cases are, then, ver different. With a persistent cow it is imperative that a shor rest be given, but more than 6 weeks is a waste of time an hence uneconomic. With the non-persistent cow each week' rest, presumably up to some, at present, undetermined uppe limit, will increase the next lactation by about 3 per cent Whether it will pay to give a short or a long rest under thes conditions cannot be stated dogmatically. In any case th decision of the question does not commonly arise, for thi type of cow helps herself to plenty of rest by drying off som time before calving. This latter is the cow that will respon best to the "steaming up" process, which will help her i the direction in which she is weakest, *i.e.*, in keeping th yield up after the flush is past. With the naturally persisten cow, however, it is rest, rather than "steaming up," that i required; feeding during the dry period in her case will b good as far as it makes good her losses if she is in poo condition, but will not provoke much response in the nex lactation.

It has always surprised the writer that scientists have taken so little interest in the effects of the dry period. Carefully controlled experiments both on the actual length of time dry and on the feeding during that period would shed much light on the mechanism of milk secretion. The matter is one of intense scientific interest, and one of those happy cases where the inquirer can satisfy his own inquisitiveness, and

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6·2	4 6
Maize	81	6·8	4 14
Decorticated ground nut cake	73	41·0	7 5
" cotton cake	71	34·0	8 15

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·11 shillings, and per unit protein equivalent, 2·40 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1930, issue of the Ministry's JOURNAL.)

FARM VALUES

Crops	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	5 3
Oats	60	7·6	4 5
Barley	71	6·2	4 14
Potatoes	18	0·6	1 1
Swedes	7	0·7	0 9
Mangolds	7	0·4	0 9
Beans	66	20·0	6 1
Good meadow hay	37	4·6	2 12
Good oat straw	20	0·9	1 4
Good clover hay	38	7·0	2 19
Vetch and oat silage	13	1·6	0 18
Barley straw	23	0·7	1 7
Wheat straw	13	0·1	0 15
Bean straw	23	1·7	1 10

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2. Price 6d. net.

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	7 5	0 11	6 14	72	1 10	0·98	9·6
Barley, British feeding ..	—	—	5 15	0 8	6 14	71	1 11	1·03	6·2
" Danubian	15 3	400	4 5	0 8	3 17	71	1 1	0·58	6·2
" Persian	15 6	"	4 7	0 8	3 19	71	1 1	0·58	6·2
" Russian	15 3	"	4 5	0 8	3 17	71	1 1	0·58	6·2
Oats, English, white	—	—	6 7	0 9	5 18	60	2 0	1·07	7·6
" " black and grey	—	—	6 0	0 9	5 11	60	1 10	0·98	7·6
" Canadian mixed feed ..	13 9	320	4 17*	0 9	4 8	60	1 6	0·80	7·6
" Argentine	12 9	"	4 10	0 9	4 1	60	1 4	0·71	7·6
" Chilian tawny	14 3	"	5 0	0 9	4 11	60	1 6	0·80	7·6
" German	23 9	"	8 7*	0 9	7 18	60	2 8	1·43	7·6
Maize, Argentine	20 9	480	4 17	0 9	4 8	81	1 1	0·58	6·8
" South African	19 6	"	4 12§	0 9	4 3	81	1 0	0·54	6·8
Beans, English Winter ..	—	—	6 10§	1 2	5 8	66	1 8	0·89	20
Peas, Indian	—	—	9 15†	0 19	8 16	69	2 7	1·38	18
" Japanese	—	—	17 5†	0 19	16 6	69	4 9	2·54	18
Dari	—	—	8 0	0 10	7 10	74	2 0	1·07	7·2
Milling offals—									
Bran, British..	—	—	4 7	0 19	3 8	42	1 7	0·85	10
" broad	—	—	5 12	0 19	4 13	42	2 3	1·20	10
Middlings, fine, imported ..	—	—	5 17	0 15	5 2	69	1 6	0·80	12
" coarse, British ..	—	—	5 2	0 15	4 7	58	1 6	0·80	11
Pollards, imported	—	—	4 12	0 19	3 13	60	1 3	0·67	11
Meal, barley	—	—	5 17	0 8	5 9	71	1 6	0·80	6·2
" maize	—	—	6 12	0 9	6 3	81	1 6	0·80	6·8
" " South African ..	—	—	5 17	0 9	5 8	81	1 4	0·71	6·8
" " germ	—	—	5 15	0 14	5 1	85	1 2	0·62	10
" locust bean	—	—	6 5	0 7	5 18	71	1 8	0·89	3·6
" bean	—	—	9 10	1 2	8 8	66	2 7	1·38	20
" fish	—	—	18 0	2 17	15 3	53	5 9	3·08	48
Maize, cooked flaked	—	—	7 10	0 9	7 1	83	1 8	0·89	8·6
" gluten feed	—	—	6 15	0 17	5 18	76	1 7	0·85	19
Linseed cake, English, 12% oil	—	—	9 17	1 6	8 11	74	2 4	1·25	25
" " " 9% "	—	—	9 5	1 6	7 19	74	2 2	1.16	25
" " " 8% "	—	—	9 0	1 6	7 14	74	2 1	1·12	25
Soya bean cake, 5½% oil ..	—	—	8 2*	1 16	6 6	69	1 10	0·98	36
Cottonseed cake—									
" " English, 4½% oil	—	—	4 5	1 4	3 1	42	1 5	0·76	17
" " Egyptian, 4½% "	—	—	3 15	1 4	2 11	42	1 3	0·67	17
Decorticated cottonseed meal, 7% oil	—	—	9 5*	1 16	7 9	74	2 0	1·07	35
Ground-nut cake, 6-7% oil ..	—	—	5 15§	1 4	4 11	57	1 7	0.85	27
Decorticated ground-nut cake, 6-7% oil	—	—	7 5	1 17	5 8	73	1 6	0·80	41
Palm kernel cake, 4½-5½% "	—	—	5 15§	0 15	5 0	75	1 4	0·71	17
" " " meal, 4½% "	—	—	6 5§	0 15	5 10	75	1 6	0.80	17
" " meal 1-2% oil ..	—	—	4 15	0 16	3 19	71	1 1	0·58	17
Feeding treacle	—	—	5 15	0 8	5 7	51	2 1	1·12	2·7
Brewers' grains, dried ale ..	—	—	4 5	0 16	3 9	48	1 5	0·76	13
" " " porter ..	—	—	3 17	0 16	3 1	48	1 3	0·67	13
Malt culms	—	—	5 10†	1 4	4 6	43	2 0	1·07	16
Dried sugar beet pulp ..	—	—	5 7	0 8	4 19	65	1 6	0·80	5·2

* At Bristol. † At Liverpool. § At Hull.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of October and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £7 per ton, then since its manurial value is 15s. per ton as shown above, the food value per ton is £6 5s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per *unit of starch equivalent* is 1s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0·89d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices :—N., 8s. 1d.; P_2O_5, 2s. 11d.; K_2O, 3s. 2d.

at the same time produce practical results. It is undeniable that the dry period has a great effect on yield, and that the best is not made of it. We are almost in a position now to say what the general principle should be for the average cow, but that animal is so rare that it should be only found in a Zoo! With more fundamental knowledge of the subject, flexible rules could be laid down, that, if followed, would lead to a considerable increase in the yield per cow.

* * * * * *

MISCELLANEOUS NOTES

The Agricultural Index Number

PRICES of agricultural produce during October were on average 29 per cent. above those ruling in the base years, 1911-13, as compared with 42 per cent. a month and a year earlier and 35 per cent. in August. The fall of 13 points in the index figure was occasioned primarily by the lower indices recorded for milk and hay, with fat cattle and potatoes contributing to a lesser degree.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925:—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	37
May	57	50	42	54	44	34
June	53	48	41	53	40	31
July	49	48	42	45	41	34
August	54	49	42	44	52	35
September	55	55	43	44	52	42
October	53	48	40	39	42	29
November	54	48	37	41	44	—
December	54	46	38	40	43	—

Grain.—Values for wheat receded further during the period under review, the average price falling by 4d. per cwt. to 6s. 11d. and the index number was 4 points lower at 7 per cent. below pre-war. Barley, however, showed a further substantial advance of about 1s. per cwt. and the index figure was 10 points higher on the month at 13 per cent. above 1911-13. In the case of oats, the rise of 2d. per cwt. was proportionate to that which occurred in the base years and the index was unaltered at 12 per cent. below pre-war. As

compared with a year ago, wheat was cheaper by about 2s. 6d. per cwt., barley by 8d. and oats by 1s. 8d., the index numbers being lower by 34, 8, and 24 points respectively.

Live Stock.—Quotations for fat cattle were rather lower than in September and the index figure fell by 4 points to 31 per cent. above the level of the base years. Values for fat sheep, however, were well maintained at an average of 62 per cent. in excess of pre-war. A further reduction occurred in bacon pig prices and the index number declined by 8 points to 25 per cent. above 1911-13. On the other hand, porkers showed a slight recovery over September and the index appreciated by one point to 45 per cent. above pre-war. Dairy cows were a little dearer on the month, but as the increase was proportionately less marked than in the base years, the index number was one point lower at 30 per cent. in excess of 1911-13. Store cattle also rose in price, but the index figure was unaltered. Although values for store sheep were fully 1s. per head above those recorded in September, the index number declined by 7 points, the rise between September and October of the base years being much more pronounced. Prices of store pigs fell away somewhat, but the index number was stationary at 107 per cent. above 1911-13. A year ago, store pigs were 95 per cent. dearer than pre-war.

Dairy and Poultry Produce.—Milk was a little cheaper on the month and this reduction, coupled with the effect of the rise from summer to winter prices that took place at the corresponding period of the base years, caused the October index to fall by as many as 53 points to 47 per cent. in excess of pre-war. A year ago the index fell by 52 points to 55 per cent. above 1911-13. Butter was further reduced in price to 14 per cent. above 1911-13. Values for cheese also moved downwards, the index number being 5 points lower at 17 per cent. above the base level. The seasonal advance in egg prices was again in evidence and the index figure rose by 20 points to 56 per cent. in excess of pre-war. At the corresponding period last year, the index for eggs appreciated by 24 points to 81 per cent. above 1911-13.

Other Commodities.—The index figure for potatoes fell by 11 points to 40 per cent. in excess of pre-war, whereas in October, 1929, values were at a much lower level, the index figure being only 17 per cent. above 1911-13. Both clover and meadow hay were about 10s. per ton cheaper on the month and the combined index for hay declined by 15 points to 4 per cent. below the base level. Although the hay index

has not infrequently fallen below pre-war during recent years, the latest figure is the lowest recorded in any month since the early part of 1915. The index number for fruit was unchanged at 6 per cent. and that for vegetables rather higher at 36 per cent. above 1911-13. Values for wool were further reduced to 12 per cent. below pre-war.

Index numbers of different commodities during recent months and in October, 1928 and 1929, are shown below :—

Percentage increase as compared with the average prices ruling in the corresponding months of 1911-13.

Commodity	1928	1929	1930			
	Oct.	Oct.	July.	Aug.	Sept.	Oct.
Wheat	28	27	2	4	—3*	—7*
Barley	26	21	—12*	—12*	3	13
Oats..	27	12	—20*	—13*	—12*	—12*
Fat cattle	31	31	30	37	35	31
„ sheep	52	55	66	62	62	62
Bacon pigs	26	50	40	41	33	25
Pork „	33	64	49	50	44	45
Dairy cows..	39	34	32	35	31	30
Store cattle..	20	11	29	30	27	27
Store sheep..	54	53	78	66	69	62
Store pigs	31	95	100	112	107	107
Eggs	66	81	44	40	36	56
Poultry	51	45	47	43	40	39
Milk	57	55	58	58	100	47
Butter	55	55	31	33	24	14
Cheese	78	37	32	28	22	17
Potatoes	51	17	23	25	51	40
Hay	6	40	18	15	11	—4*
Wool	70	42	—4*	—5*	—8*	—12*

* Decrease.

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Revision Course in Cheese-making for Dairy Teachers

THE Revision Course in Cheese-making for Dairy Teachers, to which reference was made in the July, 1930, issue of this JOURNAL, was held at Reading during the week ended September 27 last. Thirty-three teachers, including five demonstrators, attended the course, representing the following County Education Authorities or Educational Institutes :—

Berkshire, Carmarthen, Cheshire, Denbigh, Devon, Dorset, Durham, Essex, Glamorgan, Gloucestershire, Hertfordshire, Lancashire, Leicestershire, Monmouth, Nottinghamshire,

Somerset, Staffordshire, Suffolk (E), Sussex (E), Wiltshire, Worcestershire, British Dairy Institute, Chadacre Agricultural Institute, Leeds University, Midland Agricultural College, National Institute for Research in Dairying, Royal Agricultural College, Circencester, Seale-Hayne Agricultural College, Studley College, Warwickshire.

The syllabus of the course comprised four morning sessions, devoted to demonstrations of the principal varieties of cheese, and three afternoon sessions for discussions on hard cheese, blue-veined cheese and soft cheese, respectively. The remaining afternoon was occupied by a visit to the National Institute for Research in Dairying, and the value of the course as a whole was generally acknowledged by the teachers in attendance. The discussions were productive of much useful information.

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The World's Poultry Science Association

THE poultry industry is indebted to the World's Poultry Science Association for the inauguration of World's Poultry Congresses. This Association was established in 1912 as the International Association of Poultry Instructors and Investigators, its objects being to facilitate in all ways the exchange and dissemination of knowledge pertaining to the poultry industry and to encourage scientific research and practical experimentation. In order to further the aims of the Association its official organ, *International Review of Poultry Science*, is published quarterly and circulated free to all members. This publication contains summaries of reports on educational and research work on poultry problems carried out throughout the world.

Particulars of membership of the Association may be obtained from the European Secretary, Dr. B. J. C. Te Hennepe, Rotterdam, Diergaardesingel 96a, Holland, or from the General Secretary, Dr. G. F. Heuser, Ithaca, New York, U.S.A.

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Redemption of Tithe Rentcharge

THE Minister announces that for the purpose of the redemption of tithe rentcharge for which application is made after October 31, 1930, until further notice, the compensation for redemption will be 22½ times the net amount of the tithe rentcharge after the deductions prescribed by the Tithe Acts, 1918 to 1925, have been made.

Agricultural Congress and Exhibition at Angora, 1931.—A National Agricultural Congress will be held at Angora, Turkey, commencing January 1, 1931, under the auspices of the National Society for Economy and Thrift, an influential body whose President is also President of the Turkish National Assembly, and whose administrative council is composed of leading personages in the Republic. In conjunction with the Congress, an International Agricultural Exhibition, comprising, among other things, appliances, machinery, fertilizers and feeding stuffs, cattle medicine, etc., and methods of irrigation, has been arranged, the opening date of the Exhibition being fixed for January 5.

* * * * * *

Agricultural Exhibition in Egypt, 1931.—The fourteenth Egyptian Agricultural Exhibition, which will take place at Gezirah, Cairo, next February, is being well supported by the Egyptian Government, a large section of the buildings now in course of construction having been taken over by the Ministry of Agriculture. The Palace of Industry has been enlarged by the addition of two new wings, and will be occupied by the Department of Commerce and Industry. The rapidity with which space in the section devoted to agricultural machinery is taken up by overseas manufacturers is no doubt due to the knowledge that imports of agricultural machinery and implements into Egypt have nearly trebled during the past three years. A handbook in English and French setting forth full details of the objects of the Exhibition and other information of interest can be obtained gratis on application to the Director, Royal Agricultural Society of Egypt, Post Office Box 63, Cairo.

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Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on Tuesday, October 21, 1930, at 7 Whitehall Place, London, S.W.1, the Right Hon. Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying these decisions into effect.

Cambridgeshire and Isle of Ely.—An Order continuing from November 1, 1930, until October 31, 1931, the minimum and overtime rates of wages for male and female workers at present in force in the area. The minimum rates in the case of male workers of 21 years of age and over employed wholly or mainly as horsemen, cowmen or shepherds is 37s. per week of the hours necessary for the performance of the customary duties of workers so employed. In the case of other male workers of 21 years of age and over the minimum rate is 30s. per week of 40 hours in the week in which Christmas Day falls, 48 hours in any other week in winter, 42 in the week in which Good Friday falls and 50 hours in any other week in summer, with overtime at 9d. per hour on week-days and 11d. per hour on Sundays, Christmas Day and Good Friday. In the case of female workers of 18 years of age and over, the minimum rate is 5½d. per hour with overtime at 7d. per hour.

Cheshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male workers and minimum rates of wages for female workers from November 1, 1930, to May 1, 1931. The minimum rate in the case of male workers of 21 years of age and over is 35s. per week of 54 hours with overtime at 9d. per hour, and in the case of female workers of 18 years of age and over 6d. per hour for all time worked provided that in the case of such workers engaged for milking the wage shall be not less than 6d. per "meal," *i.e.*, each occasion on which a worker visits her place of employment for the purpose of milking.

Northamptonshire and Soke of Peterborough.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from October 26, 1930, until October 24, 1931. The minimum rates in the case of male workers of 21 years of age and over is 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 hours in any other week in winter, 41 hours in the weeks in which Easter Monday and Whit Monday fall, and 50 hours in any other week in summer with overtime at 9d. per hour on week-days and 11d. per hour on Sundays, Easter Monday, Whit Monday and Christmas Day. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 7½d. per hour on week-days and 9d. per hour on Sundays, Easter Monday, Whit Monday and Christmas Day.

Oxfordshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from October 26, 1930, until October 31, 1931. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 in any other week in winter, 41 hours in the weeks in which Easter Monday and Whit Monday fall and 50 hours in any other week in summer with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays, Easter Monday, Whit Monday and Christmas Day. In the case of female workers of 15 years of age and over the minimum rate is 6d. per hour with overtime at 7½d. per hour on weekdays and 9d. per hour on Sundays, Easter Monday, Whit Monday and Christmas Day.

Warwickshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from October 28, 1930, until October 27, 1931. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 50 hours in summer and 48 hours in winter with overtime at 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6d. per hour on weekdays and 7½d. per hour on Sundays.

West Riding of Yorkshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from November 24, 1930, until November 23, 1931. The minimum rates in the case of male workers who are boarded and lodged by their employer are:—foremen, 33s. per week or £85 16s. 0d. per annum; beastmen and shepherds, 32s. per week or £83 4s. 0d. per annum; waggoners, 30s. per week or £78 per annum, with lesser rates for lads. These rates being payable in each case in respect of a week of 48 hours in winter and 52½ hours in summer with in addition not more than 12 hours per week on weekdays and three hours on Sundays for work in connection with the care of and attention to stock. In the case of waggoners and other horsemen, beastmen and shepherds of 21 years of age and over who are not boarded and lodged by their employer the minimum rate is 42s. per week for the same number of hours as in the case of workers living in. The minimum rate for all classes of other male workers of 21 years of age and over is 36s. per week of 48 hours in winter and 52½ hours in summer. The overtime rates for all classes of male workers of 18 years of age and over are 11d. per hour on weekdays and 1s. 1d. per hour on Sundays. In the case of female workers of 18 years of age and

over the minimum rate is 6d. per hour with overtime at 7½d. per hour.

Carmarthenshire.—An Order continuing the operation of the existing minimum and overtime rates of wages for male and female workers from November 15, 1930, until November 14, 1931. The minimum rate in the case of male workers of 21 years of age and over is 31s. for a seven day week of 54 hours with overtime at 8½d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6d. per hour.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Enforcement of Minimum Rates of Wages.—During the month ending November 14, legal proceedings were instituted against 17 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines £ s. d.	Costs £ s. d.	Arrears of wages £ s. d.	No. of workers involved
Cumberland	Alston ..	—	2 8 6	1 6 6	1
Derby ..	Chapel-en-le-Frith	—	1 5 6	6 4 0	1
Devon ..	Holsworthy	1 0 0	—	17 4 0	1
Dorset ..	Weymouth ..	—	0 8 0	0 13 8	3
Durham ..	Bishop Auckland	—	0 13 0	8 6 0	1
" ..	Castle Eden	1 10 0	1 7 6	6 8 2	3
Huntingdon	Ramsey ..	0 10 0	—	†	1
Lancaster ..	St. Helens ..	4 0 0	1 19 0	17 0 0	2
Lincoln, Holland	Long Sutton	1 0 0	—	27 0 0	1
" Kesteven & Lindsey	Market Rasen	*	—	8 16 0	1
N'umberland	Morpeth ..	1 0 0	0 8 0	2 9 1	1
Salop ..	Bishops Castle	—	0 9 6	16 0 0	1
" ..	Shrewsbury	5 0 0	—	4 17 6	2
Somerset ..	Temple Cloud	1 1 0	2 2 0	6 3 9	1
Yorks. W.R.	Tadcaster ..	—	—	—	1
Anglesey ..	Llanerchymedd	—	—	—	2
" ..	Menai ..	—	—	—	1
		£15 1 0	£11 1 0	£122 8 8	24

* Dismissed under Probation of Offenders Act.
† Amount of arrears to be agreed.

In addition to the above proceedings were taken at Worksop against an employer under Section 9 (3) (b) for refusing to give information to the Inspector and under Section 9 (3) (a) for molesting and a fine of 2s. 6d. was imposed in each case.

* * * * * *

Foot-and-Mouth Disease.—An outbreak was confirmed on November 10 at Lockwood, Huddersfield, Yorkshire (West Riding), and the usual restrictions were applied to an area of approximately 15 miles radius round the infected premises.

Agricultural Cottages.—A Committee has been appointed by the Minister of Health and the Minister of Agriculture with the following terms of reference :—

To inquire into the conditions of occupation of agricultural cottages in England and Wales which are either let to or provided for agricultural workers in consequence of their employment. To report upon the present working of the special provisions of the Rent Restriction Acts relating to such cottages, and to make recommendations as to any alterations which may be desirable in the existing law.

This Committee has been constituted as follows :—

Mr. Walter Robert Smith, M.P. (chairman), Mr. David Black, Mr. George Dallas, M.P., Mr. H. H. George, M.C., Viscount Lymington, M.P., Mr. J. C. McGrath, Miss Picton-Turbervill, M.P.

The Secretary of the Committee will be Mr. J. J. Maynard of the Ministry of Agriculture and Fisheries, 7 Whitehall Place, London, S.W. 1, to whom all communications on the subject should be addressed.

* * * * * *

AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1930

PRODUCE OF HOPS

PRELIMINARY STATEMENT showing the ESTIMATED TOTAL PRODUCTION of HOPS in the years 1930 and 1929, with the ACREAGE and ESTIMATED AVERAGE YIELD per STATUTE ACRE in each COUNTY of ENGLAND on which Hops were grown; and the AVERAGE YIELD per ACRE of the TEN YEARS 1920-1929.

Counties, etc.	Estimated total produce		Acreage returned on June 4		Estimated average yield per acre		
	1930	1929	1930	1929	1930	1929	Average of the ten yrs. 1920–29
	Cwt.	Cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
Kent { East ..	35,900	57,000	2,685	3,311	13·4	17·2	14·1
Kent { Mid ..	48,400	77,000	3,606	4,900	13·4	15·8	13·9
Kent { Weald ..	70,700	99,000	5,529	6,661	12·8	14·8	12·3
Total, Kent	155,000	233,000	11,820	14,872	13·1	15·7	13·3
Hants	6,800	17,000	867	1,012	7·9	16·7	11·8
Surrey	1,550	1,900	140	161	11·3	12·0	11·7
Sussex	22,600	36,000	1,680	2,139	13·4	16·8	12·3
Hereford ..	48,800	50,000	3,688	3.855	13·2	12·9	9·8
Worcester ..	17,300	20,000	1,732	1,818	10·0	11·2	9·8
Other Counties* ..	950	1,200	70	129	13·4	9·4	8·9
TOTAL ..	253,000	359,100	19,997	23,986	13·1	15·0	12·3

* Salop, Gloucester and Berkshire.

Note.—The acreage returned as under hops on June 4, 1930, was about 4,000 acres less than in 1929. In addition to this reduction there

was a considerably larger area than usual, estimated at about 3,500 acres, left unpicked. The total production of the 1930 crop from the area picked is estimated at 253,000 cwt. or 106,100 cwt. less than in 1929 and 49,000 cwt. below the average for the ten years 1920-1929. Calculated on the June 4 acreage, the average yield per acre for all the hop-growing counties was 13·1 cwt. as compared with 15 cwt. in 1929 and the ten years' average of 12·3 cwt., the yield per acre in each county except Hereford being lower than in the previous year. In view, however, of the unusually large area left unpicked this year, it should be noted that, as in previous years, the estimated total production does not include the produce which might have been obtained from the area left unpicked, but that the average yield per acre has been calculated on the acreage returned on June 4. In 1930 the area left unpicked was equivalent to over 17 per cent. of the acreage returned on June 4 and, if due allowance were made for this unpicked area, the average yield per acre would not compare unfavourably with that of 1929, the yield per acre in all counties except Hants, Sussex and Worcester, calculated on this basis, being equal to or above last year's average. In Kent, which produced about 60 per cent. of the total crop, the yield per acre, based on the June 4 acreage, was 13·1 cwt. compared with 15·7 cwt. in 1929 and 13·3 cwt. for the 10 years' average. The area left unpicked in Kent, however, was estimated at 2,600 acres, and if the yield were calculated over the picked area only, the average yield per acre would be 16·8 cwt.

The quality of the hops picked was on the whole good; although there was during the growing season a greater amount of downy mildew than usual, the inferior hops were in many areas left unpicked.

* * * * * *

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

Cornwall: Mr. T. Dawson, B.Sc., Mr. J. H. Humphreys, M.Sc., and Mr. W. G. Sandercock, N.D.A., have been appointed Assistant Lecturers in Agriculture, *vice* Mr. B. Jenkins, B.Sc., Mr. A. B. Bates, B.Sc., N.D.A., and Mr. W. Williams, M.Sc. Mr. D. S. Cummins, N.D.A., replaces Mr. Sandercock as Temporary Assistant Lecturer in Agriculture.

Cumberland and Westmorland: Miss R. Taylor, N.D.D., C.D.P., has been appointed Manageress of the County Egg-Laying Trials, *vice* Miss W. Allison.

Durham: Miss W. Allison has been appointed Manageress of the County Egg-Laying Trials.

Essex: Miss M. E. Pirrie, B.Sc., has been appointed Assistant Lecturer in Agricultural Biology, *vice* Miss E. W. Jameson, N.D.H., appointed Assistant Lecturer in Horticulture and Fruit Preservation.

Lancashire: Mr. G. M. Robertson has been appointed Adviser in Poultry-keeping.

Nottinghamshire: Miss A. A. Shearman, N.D.D., C.D.D., has been appointed Assistant Instructress in Dairying.

Warwickshire: Mr. A. H. Wilson, N.D.A., N.D.D., has been appointed Assistant Agricultural Organizer, *vice* Mr. T. C. Goddard, B.Sc., N.D.D.

Wiltshire: Mr. L. D. C. McLees, B.Sc., N.D.A., N.D.D., has been appointed Assistant Agricultural Organizer, *vice* Mr. R. Wightman, B.Sc.

Mr. H. F. Burdett has been appointed Instructor in Poultry-keeping, *vice* Mr. L. C. Turnill.

WALES

Monmouthshire: Mr. F. R. Wallburton, Assistant Poultry Instructor, has resigned on being offered an appointment in Somerset.

Denbighshire: Mr. J. S. Roberts is temporarily undertaking the duties of General Science Instructor consequent on the resignation of Mr. J. H. Humphreys.

PRINCIPAL WHOLE-TIME MEMBERS OF TEACHING STAFFS AT UNIVERSITY DEPARTMENTS OF AGRICULTURE, AGRICULTURAL COLLEGES, ETC., IN ENGLAND AND WALES

School of Agriculture, University of Cambridge

Mr. H. H. Nicholson, M.A., has been appointed Lecturer in Agricultural chemistry.

The Horticultural College for Women, Swanley, Kent

The following appointments have been made since January 1, 1930:—

Horticulture

Mr. R. Lee, Foreman of the Fruit Plantations.

Miss H. Smith, Dip. Hort., Foreman of Private Glass and Propagating Department and Rock Garden.

Miss K. Clark, N.D.H., Foreman of Pleasure Grounds and Playing Fields.

Agriculture and Dairying

Miss D. Postlethwaite, N.D.D., Head of Department and Lecturer.

Miss S. St. John, Dip. Hort., Assistant.

Poultry Husbandry

Miss M. L. Sinclair, Head of Department and Lecturer.

Laboratory Staff

Miss H. M. Farries, Ph.D., N.D.A., N.D.D., Lecturer in Plant Pathology and Zoology.

Miss F. C. Schimmer, B.Sc., Assistant.

Rural Home Management

Miss I. Paterson, Domestic Subjects Lecturer.

Miss F. Record, N.D.H., Instructor in Horticulture.

* * * * * *

NOTICES OF BOOKS

British Poultry Husbandry: Its Evolution and History. By Sir Edward Brown, LL.D., F.L.S. Pp. viii+350. Illustrated. (London: Chapman & Hall, Ltd. 1930. Price 15s. net.)

The author of this work needs no introduction to the readers of this JOURNAL, but those who were interested in his article "Fifty Years of the Poultry Industry" in the issue for August last cannot fail to find this more elaborate and extensive history absorbing. Sir Edward himself warns readers that the book is not a text-book for the poultry keeper, but, as its title states, a record of the history of the "British Poultry Husbandry."

The period covered is from the very earliest time of which we have any knowledge to the present day, and the part played in the development of the modern bird by the sport of cock-fighting is clearly described. When Cæsar invaded Britain in 55 B.C. he found the inhabitants were keenly interested in this cruel sport in which they continued to be absorbed until it was prohibited in the middle of the nineteenth century. Naturally the breeders of fighting cocks desired to obtain certain qualities in their birds, and this led to what may be termed the first artificial selection. The meat value of the fowl was also early realized, and, every endeavour was made to improve the flesh-carrying capacity of the individual. Caponization

and cramming are both processes towards this end, and are of respectable antiquity.

In spite of the introduction of the turkey after America was discovered, and the trade between some districts with London in the eighteenth century—Norfolk and Suffolk for turkeys and geese, Aylesbury for ducks, Wokingham and Dorking for fowls—it was not till the nineteenth century that the production of poultry for sale really achieved large dimensions. It is only in the last 50 years that it has grown to be an integral and important part of farming economy. Sir Edward has described all the means by which the modern conditions have been arrived at, and his lifelong study of the subject has enabled him to do this as perhaps no one else could. The result is a valuable and interesting history of the industry which will, no doubt, remain for many years the standard work on the subject.

Management of Farm Poultry with a View to Profit. By Herbert Howes, with a Foreword by T. R. Robinson. Pp. xvi+180. Illustrated. (London: Chapman & Hall. 1930. Price 10s. 6d. net.)

The author of this book is the Assistant Director of the National Institute of Poultry Husbandry and was formerly head of the Poultry Department of the South-Eastern Agricultural College. He has designed his book for the use of practical men. As he says, there is still room for a large increase in our national production of poultry and eggs in spite of the rapid developments which have taken place in the past decade. He would like to see an improved class of stock kept in place of the nondescripts which still exist, and he shows how, by means of the varied educational influences that have now been at work for some time, this desirable end promises to be achieved in the future.

The book covers the whole range of the subject as fully as might be reasonably expected. It deals with the different systems of poultry keeping, houses and housing, selection of birds for egg production, foods and feeding, and the necessary seasonal work. The merits of natural and artificial incubation and rearing are discussed and chapters are devoted to table poultry production, selection and culling, diseases and their prevention, markets and the marketing of produce. Water fowl production is not overlooked, and a chapter on the breeding and rearing of turkeys is included.

The wide range of illustrations supplied cannot fail to be helpful in explaining such difficulties as may occur to the reader of the text.

Beef Cattle: Their Feeding and Management in the Corn Belt States. By Roscoe R. Snapp, M.S. Second edition. Pp. viii + 494. Illustrated. (New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1930. Price 20s. net.)

The story of beef cattle raising in the United States, which forms the opening chapters of this book, is a modern romance, but while the industry has been modified in the course of its century of life, its conditions and necessities are obviously not directly parallel with those in this country. Different forage crops, none of them general or even well known in the British Isles, form the basis of feeding there: but the experience of the writer, who is the Associate Professor of Animal Husbandry in the University of Illinois, has some lessons which may perhaps be useful to the British grazier. Among these are some of the developments that have taken place in the five years that have passed between the issue of the first edition and the publication of this, the second and revised edition.

In addition to the history of grazing in the United States, the early chapters of the book contain a description of beef cattle raising in the different countries of the world where it is practised, and some information about the methods of handling and the direction taken by the finished produce in these countries. The balance of the book covers the details of the industry from the farmer's point of view, and tells us how beef cattle are bred and cared for in the United States, and how, when they have been brought to maturity successfully, they are disposed of. The chapters on pregnancy, parturition and the care of young calves are practically universal in their application and are therefore of wide interest. Much of the rest of the book, as has been said, is hardly of direct practical bearing on the problems of British farmers, but could not fail, nevertheless, to form interesting reading for them, because some adaptation to British conditions might bring out ideas of profit and value.

Successful Canning and Preserving. By Ola Powell Malcolm. Fourth edition. Pp. xiv. + 663. Illustrated. (London: J. B. Lippincott & Co. Price 12s. 6d. net.)

This is the fourth edition of this manual, the author of which is the U.S. Department of Agriculture Field Agent for Home Demonstration Work in the Office of Co-operative Extension Work, and the book is designed to be a practical handbook for schools, clubs and home use. As the author says, the canning and preserving of food products is an important factor in household management and of even greater importance in national economy, since the conservation of foodstuffs, from the time of production and natural time of consumption to a later time, makes for a more varied and adequate diet, and that secured at a lower economic cost.

The book is a comprehensive treatise opening with a chapter on the history of the development of scientific canning, and going on to bacteriology as applied to canning. The necessary equipment is described and canning and bottling are discussed, as well as processing in hot-water baths and under steam pressure. The preparation of fruit juices, fruit, and vegetables for canning, preserves, the preservation of nuts and honey, jelly making, pickling and drying are all dealt with. The importance of fruit and vegetables in the diet is discussed, and the two final chapters touch upon curing and preserving meats and canning meat and sea food.

The conditions described and the apparatus recommended are, of course, American, but much of the book may be of service to those who propose to undertake canning and preserving in this country: there are indeed fairly lengthy quotations from Miss Watson in the pages dealing with jam-making in England.

The Dispersal of Plants throughout the World. By Henry N. Ridley, M.A., C.M.G., F.R.S., F.L.S. Illustrations by Miss M. B. Moss and the Author. Pp. xx+744. 22 plates, 1 coloured. (Ashford, Kent: L. Reeve & Co., Ltd., Lloyds Bank Buildings. 1930. Price 63s. net.)

The author of this work has set before himself the object of collecting and collating the large number of observations and records on the subject of the Dispersal of Plants that have been made from time to time for many years by different naturalists. These observations and records are scattered through the pages of a great variety of periodical and other publications, but there has so far been no adequate general work on the subject, which is all the more surprising when its very great importance is considered. A vast number of publications of all sorts has been consulted, only the most important of which are included in the bibliography, but this nevertheless fills ten closely printed pages.

The book does not attempt to give any account of the distribution, that is, the localization, or of the limits in area imposed by nature on

species of plants, as that belongs to a different subject. It treats only of the main cause of distribution of plants throughout the world, that is to say, *Dispersal*, as the title indicates. The various methods of dispersal are dealt with in the order in which they were evolved in the history of the world, viz., by Wind, Water, Animals and Man, including, at the end, various minor methods, such as explosive mechanisms and spread by creeping rhizomes, etc.

The work which the author set before himself has been well done, and the book is carefully illustrated. It will form a standard work of reference for all botanists for many years to come.

Teaching Agricultural Vocations : A Manual for teachers in preparation and in service. By Rolland Maclaren Stewart and Arthur Kendall Getman. Pp. viii+377. (New York : John Wiley & Sons, Inc. London : Chapman & Hall, Ltd. 1930. Price 15s. net.)

Very slight alterations have been made in the present second edition of this book, whose authors are respectively Professor of Rural Education at Cornell University and Specialist in Agricultural Education, New York State Department of Education. The title clearly indicates its object, but it may be added that the public the authors desired to reach are teachers in schools that we might call primary and secondary schools, although the American schools of the secondary grade are not strictly speaking precisely similar to ours.

Several books describing, incidentally to other matters, American methods of vocational teaching have already been noticed in this JOURNAL, and these methods can no longer be strange to the interested section of the British public ; but the angle from which the subject has been approached in the books noticed has been that of effect upon the pupil. Here we have a study of the use and development of these methods by the teacher and a description of the aims of the methods in practice both from the teacher's and the pupil's point of view. The book is thus likely to be useful to those who are studying with the object of becoming teachers in agricultural schools and institutes, and indeed to those already engaged in this profession and interested in the theories underlying the system which has been found of value in the United States.

Each chapter is provided with a generous list of books, in the main, of course, American, for further study if that is desired.

Essentials in the Selection of Meat for Students of Home Economics. By Viola M. Bell, B.S., M.A., and Maurice David Helser, B.S.A., M.S. Pp. xi+121. Illustrated. (New York : Wiley & Sons, Inc. London : Chapman & Hall, Ltd. 1930. Price 10s. net.)

In American high schools and colleges, the department of home economics is playing an increasingly important part in the scheme of education, and this will undoubtedly have a growing influence on the home life of the people and upon their demands upon those who supply their needs. This book is a good piece of evidence in support of these contentions, and is of a character that, with the exception of the less particularized information to be found in cookery books, is hardly likely to be paralleled at present in a British publication. Intelligent demand commands respect on the part of the supplier, and ultimately influences methods of production and systems of marketing. The assimilation of the information contained in the book will enable the meat buyer to understand the salesman's position and business, and thus to bring pressure to bear upon the trade to supply good quality and particular grades of goods, which will not be chosen in a haphazard manner easily turned away from its objective by the specious arguments known as good salemanship.

Of the authors it is enough to say that the first named was formerly Associate Professor, Foods and Nutrition Department, and the second is Professor of Animal Husbandry at the Iowa State College, so that both the production and the buying ends of meat are fully represented. The book is divided into five chapters, the first of which deals with meat generally, in its structure, food value components and other such matters, and the others with Beef, Veal, Lamb and Mutton, and Pork, respectively. Each of these deals with market classes, grades, characteristics, dressing percentage and description of cuts, so that quite comprehensive detail is supplied, which cannot fail to meet the requirements of the classes of people for whom the book was designed, the foremost amongst whom may be designated in the American style "homemakers" ; it is obvious also that it will be of interest to a number of other readers. It should be added that the book is very fully illustrated.

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SELECTED CONTENTS OF PERIODICALS

Agriculture, General and Miscellaneous

The Relation of Science to Food Production : Wheat. *R. Ruggles Gate* (Quarterly Summary Roy. Bot. Soc. London, No. 45 (July, 1930), pp. 6-10). [338.9 ; 37 ; 63.311.]

Emigration of Scottish Agricultural Workers. (Scot. Jour. Agric., xiii, 3 (July, 1930), pp. 307-310.) [325.2 ; 331 (41).]

The Weed Seed Population of Arable Soil. I.—Numerical Estimation of Viable Seeds and Observations on their Natural Dormancy. *W. E. Brenchley* and *K. Warington*. (Jour. Ecol. xviii, 2 (Aug., 1930), pp. 235-272.) [63.259.]

The Biological Decomposition of Plant Materials. Part III. Physiological Studies of Some Cellulose-decomposing Fungi. *A. G. Norman*. (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 575-613.) [576.8.]

Economics

The Effect of Size and Shape of Fields on Costs and Profits. *R. McG. Carslaw*. (Jour. Yorks. Agric. Soc., 1930, pp. 92-98.) [338.1 ; 63.191.]

The Cost of Tractor Work on the Farm. *M. A. Knox*. (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 209-213.) [338.58 ; 63.175.]

Cost of Labour in German Agriculture. (Int. Lab. Rev., xxii, 1, 1930, pp. 81-84.) [331 (43) ; 338.58.]

The Scottish Potato Market. *D. W. Innes*. (Scot. Jour. Agric., xiii, 3 (July, 1930), pp. 235-242.) [63.512 : 31 ; 63.512 : 38.]

Problems in Co-operative Marketing of Turkeys. (Jour. Farm Econ., xii, 3 (July, 1930), pp. 469-471.) [334.6 ; 63.6 : 38 ; 63.652.]

Research

A Method of Estimating the Yield of a Missing Plot in Field Experimental Work. *F. E. Allan* and *J. Wishart*. (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 399-406.) [37 (01).]

Studies in Crop Variation, VIII. An Application of the Resistance Formula to Potato Data. *R. J. Kalamkar* (Jour. Agric. Sci. xx, 3 (July, 1930), pp. 440-454.) [37 (01) ; 63.3 ; 63.512-16.]

The Relationship between the Experimental and the Demonstration Plot and their Relative Value to the Investigator, the County Officer and the Fruit Grower. *T. N. Hoblyn*. (Ann. Rept., East Malling Res. Stn., 1929 (Part I, General), pp. 40-55.) [37 (01) 37:635 ; 63.41.]

Soils

"Single Value" Soil Properties. A Study of the Significance of Certain Soil Constants. III.—Note on the Technique of the Keen-Raczkowski Box Experiment. *J. R. H. Coutts.* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 407-413.) [63.112.]

"Single Value" Soil Properties. A Study of the Significance of Certain Soil Constants. IV.—A Further Note on the Technique of the "Box" Experiment. *B. A. Keen.* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 414-416.) [63.112.]

Studies on the Carbon and Nitrogen Cycles in the Soil. I. Introductory. *H. J. Page.* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 455-459.) [63.113.]

Studies on the Carbon and Nitrogen Cycles in the Soil. II.—The Extraction of the Organic Matter of the Soil with Alkali. *C. W. B. Arnold* and *H. J. Page.* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 460-477.) [63.113.]

Studies on the Carbon and Nitrogen Cycles in the Soil. III.—The Formation of Natural Humic Matter. *M. M. S. du Toit* and *H. J. Page.* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 478-488.) [63.113.]

Note on the Occurrence of Elementary Carbon in Soils. *G. W. Robinson* and *W. McLean.* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 345-347). [63.113.]

The Carbon-Nitrogen Ratio of Soil Organic Matter. *W. McLean.* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 348-354.) [63.113.]

Note on the Determination of Exchangeable Sodium in Soils. *Rice Williams.* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 355-358.) [63.113.]

Studies in Soil Cultivation. V.—Rotary Cultivation. *B. A. Keen* and the Staff of the Soil Physics Dept., *Rothamsted Experimental Station.* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 364-389.) [63.17; 63.19; 63.191.]

Decomposition of Keratin by Soil Micro-Organisms. *H. L. Jensen.* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 390-398.) [63.115.]

The Effect of a "Soil Mulch" on the Quantity of Water lost from a Given Soil by Evaporation. *E. S. West.* (Jour. Counc. Sci. Ind. Res. (Australia), iii, 2 (May, 1930), pp. 97-105.) [63.112; 63.13.]

Field Crops

The Influence of One Crop on the Following Crop. *W. M. Findlay.* (Scot. Jour. Agr., xiii, 3 (July, 1930), pp. 293-299.) [63.191.]

Manuring of Crops in Dumfries and Galloway. *J. Gillies.* (Trans. Highl. Agric. Soc. Scot., xlii, 1930, pp. 152-168.) [63.16.]

Flax Production on a Factory System. I.—Introductory. *G. O. Searle.* (Report from the Linen Industry Research Association.) (Bull. Imp. Inst., xxviii, 2 (July, 1930), pp. 146-155.) [63.34111; 677.]

Agricultural Meteorological Scheme. Precision Records on Wheat, 1928-30. *J. A. Rudderham* and *C. C. Webster.* (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 216-219.) [551.5; 63.311.]

Studies in Crop Variation. VII.—The Influence of Rainfall on the Yield of Barley at Rothamsted. Completed by *J. Wishart* from an Investigation initiated by *Winifred A. Mackenzie.* (Jour. Agric. Sci., xx, 3 (July, 1930), pp. 417-439.) [551.5; 63.3; 63.313.]

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NOTES FOR THE MONTH

Conference on Allotments for the Unemployed

A CONFERENCE of Urban Allotment Authorities, convened by the Minister, was held at the Caxton Hall, Westminster, on November 18, when the proposals, contained in the Agricultural Land (Utilization) Bill, for encouraging the cultivation of allotment gardens by unemployed persons were explained and discussed. About 500 delegates from all parts of England and Wales, representing County, Borough and Urban District Councils, attended. Representatives of the Land Union, the Central Landowners' Association, the Chartered Surveyors' Institution and other bodies were also present. The Prime Minister presided at the opening.

The Prime Minister said that one of the great problems which confront this nation was the problem of how to return our people to the soil. There was a very large section of the industrial population who, like himself, had come from the soil and who, if they took a spade in their hands, would soon be able to recall arts that had been disused and that could be called into use and operation again. There had been one of the most extraordinarily interesting experiments carried on under the pressure of industrial distress in the Rhondda Valley. He was glad to see the great inspirer of that plan, Mr. John Robson, on the platform. After discussing some of the results of this work the Premier said that the Government had come definitely and enthusiastically to the conclusion that this work, extended by the beneficent assistance given by the Mansion House Fund, should become a national endeavour, organized through and with the assistance of public authorities. He was glad to say that they had prevailed on Sir William Waterlow, the late Lord Mayor of London, to consent to be Chairman of the voluntary organization it was proposed to set up to work in conjunction with the local authorities and the Government.

Mr. John Robson referred to the successful results achieved by voluntary effort in South Wales and elsewhere, and said that they had found that with co-operation, knowledge and education it was possible to make their potato patches into gardens of which they might be proud.

Dr. Addison, Minister of Agriculture, who took the Chair on the departure of the Prime Minister, said the matter was entirely non-party. They asked for the co-operation of all concerned. There was no time to be lost because it was important that land should be available so that men could get their planting started in the spring. They would try to plan the scheme so that it was not merely a flash in the pan, and to take advantage of the best experience available and to put the scheme on a permanent basis.

Lord Strachie, representing the Central Landowners' Association, and the Rt. Hon. E. G. Pretyman, representing the Land Union, spoke in support of the proposals. A number of questions were put and suggestions made by delegates, to which Mr. H. L. French, a Principal Assistant Secretary at the Ministry, replied.

Copies of the full report of the conference may be obtained, free of charge, from the Ministry's offices.

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The Agricultural Marketing Bill

AT the end of last Session, the Government introduced the Agricultural Marketing Bill for purposes of discussion. On Thursday, December 18 last, the Minister reintroduced the Bill in an amended form. Although the Bill has in no way been changed in principle, some of the amendments are of consequence.

A new clause has been introduced empowering the Minister to appoint one or more Reorganization Commissions which will have a dual function. The primary function of a Commission will be to examine existing methods and arrangements, and to prepare a detailed scheme for regulating the marketing of a particular product by the producers thereof; and the Minister will be required to take steps to further the consideration of the scheme by the producers concerned. The secondary duty of a Commission will be to investigate, if so required by the Minister, the relation of other interests (such as manufacturers or distributors) to any scheme with a view to securing their co-operation. This new clause should meet with the approval both of those who had misgivings as to the use which farmers would make of the Bill and of those who regard the solution of problems, such as the milk surplus, as impracticable unless the manufacturing and distributive interests are consulted and participate.

Other amendments provide for the exemption of classes of sales as well as of classes of producers; for enabling a board to secure for its producers the business advantage of bulk purchase of agricultural requisites; and for increasing the usefulness of a board by permitting it to guarantee an agricultural charge (under the Agricultural Credits Act, 1928) when created by a registered producer.

Finally, fruit and eggs have been added to the list of products to which the Bill applies, the former at the request of English, and the latter of Scottish, producers.

(Copies of the Bill, in the form in which it has been introduced, may be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2.)

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Calf Rearing

A NEW publication recently issued by the Ministry is Bulletin No. 10 which deals with the important subject of Calf Rearing. The object of the Bulletin is to give a brief account of those methods of calf rearing which have proved successful in different parts of the country. In matters of detail, there is a wide variation in the practice of different districts. These differences, however, depend mainly upon the extent to which whole milk or separated milk enters into the ration, the variation ranging from the unrestricted use of milk on the one hand to its practical exclusion on the other.

The particular method of rearing adopted depends largely upon the system of farming. In upland districts, where plenty of grass is available, in non-dairying districts generally, where the grass is of good quality and winter keep can be grown cheaply, and in every district where high-class pedigree dairy stock are reared, milk is fed liberally to the calf. On milk-selling and cheese-making farms, however, strict economy must be exercised in the matter. Butter-making farms occupy an intermediate position between these two extremes, because, although whole milk cannot be used freely, a plentiful supply of skimmed or separated milk, or butter-milk, is usually available for calf rearing.

The Bulletin deals with the various phases of calf rearing; the construction and essential requirements of the calf house; the care of the new-born calf, suckling and hand-feeding; and the restricted and unrestricted use of whole milk. A dietary for the first six months of the calf's life should prove

useful to rearers. Copies of the Bulletin may be obtained from the Ministry, price 5d. net, post free.

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Production of Home-Grown Beet Sugar

ACCORDING to returns made to the Ministry by the beet sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during November, 1930, together with the quantity produced during the corresponding month in 1929, was :—

	cwt.
November, 1930	2,419,700
November, 1929	2,050,965

The total quantities of sugar produced during the two manufacturing campaigns to the end of November were :—

	cwt.
1930-31	4,728,880
1929-30	3,519,478

* * * * * *

Immunization of Cattle Before Export

A DETERRENT to the export trade in British cattle to tropical and sub-tropical countries is that overseas buyers realize the risk of importing susceptible animals when they are likely to come in contact with diseases which are prevalent in the importing country. It is well known that very serious losses have occurred—particularly from piroplasmosis and anaplasmosis—in British cattle imported by South African and South American countries.

Immunization against piroplasmosis and anaplasmosis can now be carried out at the Veterinary Laboratory of the Ministry of Agriculture and Fisheries, New Haw, Weybridge, Surrey, and stockowners desirous of having cattle immunized before export should apply for particulars of immunization and cost to the Director, Veterinary Laboratory, as above.

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Varieties of Cereals for Spring Sowing

THE following note has been communicated by the National Institute of Agricultural Botany, Cambridge :—At the turn of the year thoughts of the spring sowings begin to occupy the farmer's mind. It is timely to insist on the importance of choosing the right variety. The difference in results between two varieties may be as great as 20 per cent., yet it costs no more to grow good varieties than bad ones. Farmers would certainly often save money by leaving new varieties alone until it is known how

they have behaved in the trials carried out every year by agricultural institutes. The past season has again seen the introduction of new varieties, but the trials conducted at six centres by the National Institute of Agricultural Botany and the observation plots grown in co-operation with the Institute by many County Agricultural Organizers show that, though there are some varieties of promise at present under test, farmers in the Midlands and South of England cannot yet be safely recommended to grow other varieties than those of which brief particulars are given below.

Spring Wheat.—This is not often a profitable crop. Of the available varieties the weak-strawed APRIL BEARDED is quickest to ripen, but RED MARVEL and A1 are the most generally useful.

Spring Barley.—PLUMAGE-ARCHER on the most fertile soils, SPRATT-ARCHER where fertility is low, or either in other ordinary circumstances should be the choice of the farmer who wants a good crop of malting barley. For very late sowing the early-ripening VICTORY is worth consideration.

Spring Oats.—VICTORY is the most generally profitable variety and GOLDEN RAIN is as good when the crop is to be consumed on the farm. ABUNDANCE combines the highest quality with adaptability to a wide range of soils, but THOUSAND DOLLAR should be preferred where farming is high. MARVELLOUS stands well even on very rich soil and, sown early, yields heavy though coarse-grained crops.

Farmers who want further information about these or other varieties can obtain it either from their County Agricultural Organizer or from the National Institute of Agricultural Botany, Cambridge.

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Systems of Dairy Farming

THE College of Estate Management has printed for private circulation the first of a series of agricultural monographs. These monographs will be reports presented by scholarship holders who have been enabled to travel in this country and abroad by means of the travelling scholarship awarded by the College. The present volume deals with systems of dairy farming and is the report of Mr. W. E. Cole, who was the first scholar appointed by the College, and held the scholarship for two consecutive years.

Mr. Cole presents an interesting and extensive survey of systems of dairy farming in many countries, which forms an important addition to knowledge on this subject. During the

holding of the scholarship, some 172 dairy farms were visited in Great Britain, accounts in respect of 108 of which were available, and in 63 cases data from complete cost accounts were willingly disclosed. The districts covered included every English county except Cornwall (from lack of time), 21 Scottish counties and several in Wales. About twelve months of the period were spent in the British Isles, and the remaining twelve months in various other parts of Europe, including Denmark, Sweden, Norway Belgium, Holland, France, Switzerland, Italy and Austria.

This scholarship should prove a valuable supplement to existing scholarship schemes. It is awarded annually and is of the value of £300. Any inquiries in connexion with this Report or the Scholarship should be addressed to the Secretary of the College, 35 Lincoln's Inn Fields, London, W.C. 2.

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Seed Potato Certification

To the grower of potatoes, the purity of his crop is a matter of considerable importance. A badly mixed crop—a most unsatisfactory result in any case—may lead to financial loss and it is very desirable, therefore, that precautions should be taken to ensure that potatoes obtained for planting are true to type. Under the Seeds Act and Regulations it is illegal to sell seed potatoes as being of any specific variety if they contain rogues to the extent of more than 3 per cent. An even higher standard of purity is required by the Ministry's inspection and certification scheme under which the minimum standard of purity is 99·5 per cent. Growers would be well advised when placing orders for "seed" potatoes to stipulate that the tubers must be supplied from a stock which is the subject of one of these purity certificates.

A register has just been issued giving particulars of the crops certified by the Ministry's Inspectors during the past season. Copies of this register can be obtained from the Ministry at 10 Whitehall Place, London, S.W. 1, price 1s.

Growers are reminded that under the Wart Disease of Potatoes Order of 1923, the only potatoes that may be planted in land on which Wart Disease has occurred at any time are potatoes of approved immune varieties that have been inspected whilst growing and certified as true to type and reasonably free from rogues, or potatoes of approved immune varieties saved from crops grown on the land in the previous

year. The Order further provides that on the sale of any potatoes for planting the seller must furnish the buyer with a written statement identifying the relative certificate (*e.g.*, by quoting the certificate number). In the case of potatoes of approved immune varieties, the certificate number to be quoted is that given in the register referred to above, but in the case of other varieties the number to be quoted is that of the relative "Clean Land" certificate issued to the grower concerned, and not that of the purity certificate quoted in the register. Growers who desire to sell potatoes of the 1930 crop for planting should now apply to the Ministry for a "Clean Land" certificate in respect of their premises, if they have not already done so.

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THE following note has been communicated by Dr. Thomas Milburn, Principal of the Midland Agricultural College, Sutton Bonington, Loughborough :—

Farm Drainage Records

Many farmers now keep milk records and many poultry keepers record egg production by means of trap nests, but the importance of keeping proper records of the drains on a farm has not yet received the recognition that it deserves. Estate agents frequently omit to provide a plan setting out all the drains in detail. The landlord may supply the pipes to his tenant, who will lay a length as occasion demands, neither owner nor occupier keeping a proper record of their position on the farm. Such drains are often laid alongside or across existing pipes, the result being a tantalizing network running in all directions. Having no better guide than the memory of an old labourer or local resident, each newcomer makes "confusion worse confounded," while time and money are wasted in searching for unrecorded drains. Of late years the necessity for recording drains has assumed increased importance owing to the break-up of estates.

The process of tracing an unrecorded drain from a ditch by means of trial holes dug at intervals is tedious and involves considerable labour, especially as the old drains seldom run straight and many outlets have disappeared owing to the neglect of water courses. When several fields are merged into one, a drain may be laid at the bottom of a winding ditch before the latter is filled. It frequently happens that the drains entering such a ditch are not properly connected with the new drain, and to trace their courses may be no easy matter. The

cost of new pipes is high, and if an old drain can be made effective so much the better. In the absence of a detailed survey, a sketch map showing the direction of drains, indicating junctions and outlets, and giving distances from some well-defined object, will serve a useful purpose and effect considerable saving in time, labour and expense.

* * * * * *

Economical Feeding of Stock

THE importance of good and early grazing—obtained by the proper use of artificial fertilizers on suitable fields—has been emphasized in recent years by the findings of scientists that young grass is of nearly as high a feeding value as linseed cake. The mowing of young grass, when cattle or sheep are not available to eat it, and its storage in blocks as "grass cake," has been attempted, but this does not seem to be, as yet, an economic reality.

Leafy herbage, however, mown early—or grazed first, then cut late and turned into hay—makes a good substitute for young grass or grass cake. Such hay may not contain so much protein per cent. as very young grass, but, as there is more of it, the hay, per acre, will contain a great deal more protein. Fed to stock with roots or kale, it will provide for a fair milk yield.

It is probably unwise to allow unlimited hay of ordinary quality to be fed to the heavier milking cows. It is, indeed, possible that the diminished milk yields known at this season may be due, in part, to cows being allowed to gorge themselves with hay, particularly of the poor qualities that farmers are accustomed to utilize first. Good hay, however, in moderation, with roots or kale, will produce a reasonable yield; and the question for the farmer is whether to maintain his quantity of milk by the intensive feeding of fewer cows, or to get it from a larger number fed less liberally.

There is no likelihood of a general shortage of milk this winter—it is rather the other way; and until the milk industry becomes more fully organized in the interests of farmers it seems unwise to produce a surplus to ordinary requirements. What can be done by way of organization in cheesemaking and marketing is indicated in the recently-issued Report of the Ministry on the Marketing of Cheese—a book which every dairy farmer should possess; and he can obtain it for the trifling expenditure of 9d., on receipt of which a copy will be sent by H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2.

ECONOMIC ASPECTS OF PIG RECORDING

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ALTHOUGH recent research in animal nutrition has removed many of the problems of pig-keeping, there still remains a wide field for investigation. During the past few years much attention has been paid to swine dietetics; the suitability of different feeds—protein and carbohydrate—has been examined and catalogued; an extensive literature has grown up around vitamins and minerals; while the subject has been approached from the fundamental side in the laboratory and from the practical side in large-scale feeding experiments at research stations and agricultural institutes. The results of these experiments have placed at the disposal of the farmer a mass of valuable data, the intelligent application of which can greatly reduce his feeding costs. Unfortunately, the problem does not end when the nutritional aspect is solved, and the importance of factors other than feeding, viz., small details of management, the personal touch in a good pigman, alternative types of housing, marketing, the breed and strain of the animals used, are becoming generally recognized. The full benefit of the improvement in feeding, therefore, can only be obtained when herd idiosyncrasies due to the above factors have been corrected. For this reason the scope of the problem tends to turn to breeding and management, but the general aim remains the same—to make pig-breeding pay. In any industry increased profit may be obtained:—

(1) By an increase in selling price when the cost of production remains the same;
(2) By a decrease in the cost of production when the selling price is constant; or
(3) By a combination of both these factors.

In a period of high prices the inefficient farmer may conduct business at a profit, but in the present depressed state of agriculture the margin of profit can be most readily increased by considered reductions in the costs of production. At this point, therefore, it becomes necessary to set up machinery capable of reviewing the industry as a whole, and of ascertaining the effect of the several factors in production on the cost of the commodity produced. This can be conveniently carried out by a system of survey.

As trap-nesting and milk recording evaluate the efficiency of the hen and the cow, so pig recording helps the farmer to assess (1) his efficiency as a producer of pig meat, and (2) the efficiency of his sow; this places him in a position to remove the unprofitable units from his herd and to select breeding

stock from strains that have proved prolific and efficient converters of food into flesh.

The various types of pig recording employed in England and elsewhere have been described in detail in the November, 1929, issue of this JOURNAL and in the three Reports of the East Anglian Pig Recording Scheme * already published. The objects of the scheme are summarized as follows :—

(1) To measure and compare the economic capacity of the individual sows and boars in a farmer's herd.
(2) To help the farmer to locate where and how his herd and his management are succeeding or failing in pig production.
(3) To enable the farmer to compare the average yearly results of his own herd with previous years, or with the results of other herds for the same or previous years.
(4) To supply a rational basis for the sale of breeding stock and for utility classes at livestock shows in the same way as milk records are employed in the sale and judging of dairy cattle.
(5) To collect reliable data on a large scale suitable for detailed and scientific analysis by trained investigators. From these results suitable standards of production could be compiled and light could be thrown on many problems that cannot be easily or economically investigated by ordinary experimental methods. Such records would also form a basis for comparing the efficiency of the British producer with that of his chief competitors.

Pig Recording in East Anglia.—Pig recording in England originated in East Anglia in 1927, the object being to determine a scheme of recording suited to English conditions. The first 18 months were spent getting together a body of interested farmers and in perfecting details of administration. At the outset it was hoped that all pigs of which the pre-weaning records were obtained would be disposed of through one or other of the bacon factories acting as slaughter centres, but it was found that members were unwilling to agree to any specific method or place of marketing, and certain adjustments had to be made to allow economic freedom of disposal. Live weights on the farm, dead weights returned from the pork butcher and weights on railing are now accepted in place of weights taken at the factory; factory weighings, however, are still considered ideal.

The present scheme, based on two years' experience, was introduced in October, 1929. The method of operation is briefly outlined below :—

(1) Each member is provided with a diary in which he is required to enter :—
  (a) The date of farrowing; the number of piglings born; the breed of sow and boar used; and details of subsequent deaths, of all farrows in the herd.

* Copies of each of the three reports can be obtained on application to the Organizer, Department of Agriculture, University of Cambridge, price 1s. 2d. per copy, post free.

  (b) All sales of recorded animals with, where possible, live weight at disposal, except in the case of factory disposals where live weight is taken at the factory; all deaths due to accident or disease; and particulars as to alterations in feeding and practice.

Members who also take part in the feed consumption sub-scheme enter all details as to the type and quantities of the various pig meals consumed on the farm and weights of all pigs leaving the farm—whether recorded or not.

(2) A recorder visits the farm at maximum fortnightly and minimum monthly intervals when he—
  (a) extracts relevant information from the diary;
  (b) weighs and earmarks with a distinctive earmark all young pigs on the farm within the age range of three to seven weeks;
  (c) earmarks younger litters if they are likely to be mixed before his next visit; and
  (d) notes before leaving the farm the date on which the next visit will be made.
(3) When a litter is completely disposed of, or alternatively when the pigs are 15 months of age, a final litter record is issued to the farmer. This record gives a detailed account of the pre- and post-weaning performance of the litter in question.

During the year ending March, 1930, 217 final litter records were issued for litters completely disposed of or otherwise accounted for. The averaged results of complete litters passing through the factory are given in the left-hand column below. Pig-recording standards are set down for reference in the right-hand column :—

		Recording standards
Number of pigs born alive ..	9·9	10
Number of pigs at six weeks ..	8·4	8
Average weight at six weeks ..	19·1 lb.	21 lb.
Total litter weight at six weeks ..	160·8 lb.	168 lb.
Average weight of pigs at slaughter	208·8 lb.	200 lb.
Average dead weight of pigs ..	161·4 lb.	150 lb.
Average curing weight of pigs ..	131·2 lb.	120 lb.
Number of pigs recorded at slaughter..	6·7	—
Average loss from live weight/dead weight	22·7 per cent.	25 per cent.
Average loss from dead weight/curing weight	18·7 per cent.	20 per cent.
Average age in days at slaughter	255·0	—
Average age in days at which pigs should have reached above weight	201·1	194
Average number of days wasted..	53·9	—
Average extra cost of production for pigs at 3½d. per day	15s. 9d.	—
Good quality bacon carcasses ..	38·6 per cent.	

Differences in Herd Efficiency.—Efficiency in pig production is largely controlled by :—

(1) The number of pigs born and marketed per litter; and
(2) The economy of feed consumption per lb. live weight gain.

(1) is a simple numerical estimation; and, as rate of growth is closely connected with economy of feed conversion, (2) can be conveniently estimated by comparing the time required to reach a given weight with the standard age for that weight. These two factors are used as a basis for comparing results.

During the past year it was found that the highest average number of pigs born alive in any litter was 13·5, while the lowest was 8·1. At six weeks, the first herd returned a litter average of 11·3 and the second 6·5 pigs. "As upkeep of the sow during the period of gestation and suckling has to be distributed between the pigs reared, this difference of nearly 5 pigs per litter is extremely significant. From data obtained at the Rowett Research Institute, Aberdeen, it has been calculated that the cost of weaning a litter of pigs is in the neighbourhood of £10. If this figure is correct then the difference in initial cost between litters of 10 and 5 pigs is roughly £1 per pig, or, in other words, the pig from a litter of 10 starts life with a credit of £1." (Third Report.)

On the same basis the difference in initial weaning cost per pig between the best and worst herd was 13s. As regards feeding, the worst herd required 112 days above the standard number to reach bacon weight, and, as it may be assumed that rate of growth is closely correlated with economy of feed conversion, it can be estimated that this difference in the cost of production was in the neighbourhood of 32s. 8d. per bacon pig. "It has been shown that for purposes of maintenance and movement, pigs of 100, 150 and 200 lb. live weight require 2·9, 3·3 and 3·6 lb. of meal per day. If the average figure required for maintenance during this period is taken at 3·2 lb. and the average cost of meal at 1⅛d. per lb., it may be assumed that every day spent on the farm above the standard number costs the farmer 3½d." (Third Report.)

Management.—The percentage of pigs born that are alive at six weeks gives an excellent indication of the management in any herd. In the best herd, 94·2 per cent. of the pigs born were alive at six weeks old, while in the worst herd only 62·7 per cent. remained. Pre-weaning mortality could often be avoided by a little forethought on the part of the farmer. When long straw is used as litter, young pigs are frequently overlaid. This involves unnecessary loss, and in certain herds the mortality percentage has been reduced by the use of chopped straw. Scour, overcrowding, lack of minerals, over-fed sows, uncomfortable housing, damp, draughts and unsympathetic pigmen are further causes of deaths, while for no apparent reason it is impossible to rear pigs successfully in

certain types of "model" piggeries. Lack of success in feeding was for the most part due to overcrowding, ill-balanced rations deficient in protein and minerals, the substitution of good home-grown feeds by cheap feeds of doubtful value, uncomfortable quarters, and worms.

Where pigs are running in yards, it is difficult, under the survey method, to assess the importance of the last-named factor, but it is interesting to note the following passage contained in the First Report of the Edinburgh Testing Station:—

"Worm infection is much more prevalent and caused much greater loss than is generally believed to be the case. We are of opinion that official steps should be taken to inform pig breeders and feeders how to keep their herds free of worms." This agrees with the general opinion in East Anglia.

Quality.—Of the carcasses examined during the year, 38·6 per cent. were graded as suitable for the production of first quality bacon. The average age of "Prime" carcasses was 265 days, or 12 and 20 days older than carcasses placed in the "Medium" and "Stout" grades. In the herd returning the lowest economy of gain, 76 per cent. of the carcasses were graded as "Prime." These results seem to confirm the opinion previously held that the worst quality pigs mature earliest. The lowest number of "Prime" carcasses in any herd was 5 per cent. Over 50 per cent. of the carcasses between 7 and 8 score were placed in the first grade. In carcasses of 8 to 9 score the percentage had fallen to 30. This result emphasizes the value of a weighing machine on the farm and it is certain that the labour entailed in monthly weighings of store and fattening stock would be more than repaid by the extra 6d. per score received at the bacon factory for pigs within the 7 to 9 score range. The uncertainty of the estimated weights on the farm is well illustrated by two litters (15 pigs) recently sent to the factory as baconers (approximately 200 lb.) which returned an average live weight of 249 lb. at the factory and were totally unsuited for the Wiltshire trade.

The Imperial Economic Committee, in the Report on "Pig Products," stress the necessity for the production of a uniform pig and for the co-operation of the farmer and curer to that end. Although the question of payment for quality is extremely controversial it is submitted that the uniformity desired could be obtained more quickly if the present flat rate method of payment were replaced by a system extending a bonus for

first quality pigs. Payment on the present basis offers no stimulus to the farmer who produces prime pigs, and may often act in the opposite direction, as cases have been met where a heavy-shouldered boar was used with the idea of producing heavy rapid-growing pigs of good constitution.

Breeding.—Large White Boars and Large Black Sows were the most popular sires and dams. Sows' pigs were slightly larger and heavier than those of gilts, but gilts appeared to be the better mothers, probably owing to the fact that with increasing age and weight the sow was more likely to crush the young pigs. Sows can be bred successfully up to eight or nine litters. A greater variation in live weight at six weeks old occurred in litters of cross breds than in those of pure breds. Little difference was evident in the litter average throughout the year, but pre-weaning mortality was highest during the winter months. When rib counts were taken at the factory, it was shown that the number of rib pairs was positively correlated with length of side.

Feed Consumption Scheme.—It has been shown that feeding stuffs represent 80 to 90 per cent. of the total pig-keeping costs, the remaining percentage accounting for rent, labour and incidentals. Further, as rent and labour varies but slightly between districts, this balance of 10 to 20 per cent. is fairly constant. Differences in costs of production are therefore largely accounted for by the efficiency of feeding, *i.e.*, by the amount of meal required to produce 1 lb. of pork, live or dead weight. Any measure by which feed consumed can be translated into pork produced gives an excellent idea of the value of the management in a particular herd. The general aim of the feed consumption scheme is therefore to measure the weight of pork produced by a given quantity of meal in one year. The scheme operates as follows :—

(*a*) All suckling, weaning and fattening stock in the herd are weighed at the beginning and end of the year under review ;
(*b*) A record is kept of all quantities of mixed meal consumed during the year ;
(*c*) Weights are obtained of all purchases and disposals during the year ;
(*d*) It is then possible to calculate the weight of pork produced during the year and to offset it against meal consumed.

By the above method the breeding stock is treated as the machinery of production, and their share of the feed is charged against the pigs marketed. During the past year, records of feed consumption have been completed in two herds ; the main points of the investigation are given below :—

	£	s.	d.
(1) Lb. of meal per lb. saleable live pig meat produced = 4·62 lb.			
(2) Net average cost of mixed meal (per ton)..	11	0	10
(3) Average price per score dead weight received per pig marketed	0	18	4
(4) Average price per pig marketed	7	9	5
(5) Average cost of food consumed per pig	4	14	5
(6) Average cash returned per pig over food consumed	2	15	0

"As feed-consumption records were kept for the above herd during 1928-29 it is possible to compare the present figures with those of the previous year. The main feature of the comparison is the increase from 3·97 to 4·62 lb. in the meal required to produce 1 lb. live weight per pig, an increase of ·65 lb. per lb. gain. On a 204 lb. pig—the average live weight at the factory of all pigs marketed from this herd—this represents an additional consumption during life of 1 cwt. 20 lb. of meal per pig, or a cash difference (calculated from the average price of the meal) of 12s. 11½d. During the year under review a decrease in the price of pig feeds reduced the average meal cost for the year by 1s. 6d. per cwt., and any advantage that might have been derived from this reduction was negatived by the extra amount of meal required in feeding. It is therefore evident that the increase of 29s. during the present year in the net return per pig is due to an advance of 3s. 7d. in the average price per score obtained at the factory." (Third Report.)

In the second herd, no breeding stock was kept. The pigs were bought in as weaners at £1 18s. 8d. ; 3·9 lb. of meal were required to produce 1 lb. live weight of pork ; and the average return per pig, after deducting the cost of meal and pig, was £1 11s. 2d.

Utility Pig Classes.—The application of recorded information to utility classes at livestock shows is a natural growth in the development of pig recording. At the London Dairy Show (1930) an attempt was therefore made to demonstrate the practical value of a class for recorded bacon pigs. The objects of the class may be briefly summarized as follows :—

(1) To provide a class for bacon pigs in which the requirements of farmer and curer are equally represented ;
(2) To lay down definite standards of performance to facilitate comparison of results from year to year ;
(3) To ensure that the class should be a litter test and that the litter should be adequately represented ;
(4) To credit the sow with the performance of the litter—for advanced registration.

Moreover, to meet the further objection to present-day conditions, viz., that the difference in the value of prizes

awarded is often excessive in view of the narrow margin of points separating the exhibits, a new method of assessment was introduced in which equal money awards were given to all exhibits reaching certain standards of production. The arrangement of the class was as follows :—

Six pigs from the litter of a recorded sow formed an exhibit. These pigs were recorded by an official of the East Anglian Pig Recording Scheme in the ordinary way. After weaning they were fattened on the farm and on September 18 were sent to Messrs. Harris's Bacon Factory, Ipswich, where they were weighed and slaughtered, various carcass measurements being obtained. The carcasses were subsequently cured as Wiltshire bacon, and four sides—one hog and one gilt—were sent for exhibition at the London Dairy Show. Awards, however, were made on the performance of the six pigs sent to Ipswich. These were assessed :—

(1) As to pre-weaning results (*i.e.*, number weaned, average weight at six weeks and litter variation) ;
(2) Rate of growth ;
(3) Quality.

Standards of performance based on records obtained during the past three years were laid down, and, after certain allowances had been made, the exhibits were graded as "Superior," "Standard" or "Inferior" as they agreed with these standards. First and Second Class awards were then given to all exhibits of "Superior" and "Standard" performances respectively.

Seven groups of six pigs were entered for competition, and three were assessed as "Superior," one as "Standard" and three as "Inferior." The "Inferior" exhibits were lacking in quality and were faulted on account of deficient length and too thick back fat, although it may be noted that one of these exhibits returned the best growth result for any group. The number of pigs weaned varied from 8 in the worst litter to 12 in the best. On the previous assumption that the cost of weaning a litter of pigs is in the neighbourhood of £10 this represents a difference of 8s. 4d. per pig in weaning cost. The highest average weight at six weeks old was 27½ lb., the lowest 19½ lb. The index used to measure the growth rate varied from 99 to 109 or, in other words, the litter with the highest index reached bacon weight 20 days ahead of the other, while the farmer saved 5s. 10d. per pig in cost of feed.

The above class is an attempt to bring together the interests of producer and manufacturer in a workable plan of assessment capable of application to pig classes throughout the country. It further attempts to emphasize that the

prosperity of the pig-keeper and bacon curer in this country are inter-dependent. Neither is a philanthropist, and each must receive a reasonable profit on the capital invested in his enterprise. Although the farmer is mainly concerned in marketing his pigs at a profit, he must realize that the success of his industry will be measured by the extent to which he supplies the curer with animals of suitable quality and type. On the other hand, although mainly interested in type and quality, the curer must consider that his prosperity is linked up with the prosperity of the farmer, and that unprofitable conditions in pig-keeping must react adversely on the bacon-curing industry.

Future Development.—The wide variation of results in the sample of herds recorded during the past three years clearly indicates the necessity and scope for pig recording in England. Further, the growth of the scheme from 23 to 70 members during the last six months of 1929 is a testimony to the growing popularity of the movement.

Recording forms an intimate link between the research worker and the practical farmer. In his periodic visits to the farm the recorder has an excellent opportunity of observing faults in practice that might otherwise pass unnoticed. It is not sufficient, however, that he should be able to point these out to the farmer ; he must be in a position to advise him how to cope with his problems as they arise. It is therefore essential that any system of recording should be linked up with a strong advisory service capable of dealing with problems of management, feeding and disease.

Further, the establishment of testing stations at suitable intervals, working in co-operation with the survey system and to which sample groups of typical litters from recorded herds could be sent in order that differences due to the farmer's feeding and management could be eliminated, and a measure obtained of differences in breed and strain, would provide the farmer with a pig-recording and intelligence service capable of raising the general level of production, would reduce costs and place his industry on a more equal footing with those of his Continental competitors.

* * * * * *

ANIMAL HEAT

By Professor Sir J. ARTHUR THOMSON, M.A., LL.D.,
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EVERYONE knows the pleasant warmth of a cow's neck—one of the best examples of animal heat. What a contrast when we take away our hand and pick up a frog, so cold and clammy. On a frosty morning we see the hot water-vapour from our lungs condensing into a little cloud in the cold air. Our fingers may become so numb that we are glad to put our hands in our pockets so as to be nearer the warmth of our body. We are familiar with the value of non-conducting woollen clothing in lessening our loss of heat, and in making it possible to have a sort of perpetual summer between our own skin and that of the animal from whose pelt we more or less have borrowed.

Some may have noticed the steam rising from a slaughtered sheep, or from a skinned rabbit, or even from a torn grouse left by the startled eagle—the warmed water-vapour passing into the cool air is condensed and becomes visible. Similarly from the sweating, over-driven horse warmed water-vapour steals off into the summer air, and this evaporation automatically cools the skin. On the hot day we see the panting dog with its long tongue lolling out. It is not sweating by its tongue, as some people think; it is allowing the salivary juice to evaporate, and this change from fluid to vaporous form uses up heat, the result being that the surface of the tongue is cooled, reducing the temperature of the adjacent blood, and reacting a little on the general circulation. These instances must serve to illustrate what is meant by animal heat, or the warmth produced by the living body. *What is its origin?*

Production of Animal Heat.—It is a little difficult for us to realize that "animal heat" was an enigma until the work of Lavoisier, who was guillotined by the revolutionaries in 1794. Lavoisier was the first to discern clearly that the heat given off by living creatures is the result of the union of oxygen with combustible material, just as in a burning fire. He placed the panting mouse beside the burning candle, and demonstrated that both are undergoing oxidation, each in its own way. Henceforth the "burning bush" of old became with a new meaning a symbol of the living creature, which is always burning and yet is not consumed—till the fire is eventually put out.

The foundation-fact is that heat is produced by oxidations that go on in the ordinary chemical routine of the body. It is produced in all breaking-down or katabolic changes, but by far the most of it is produced by the muscles, especially when they are contracting. We have only to think for a moment to feel sure that heat is produced even when the muscles are at rest. For during sleep, most of the muscles, except those concerned in the beating of the heart and the breathing movements, are having a rest, and yet they are producing much heat. If it were not so, we should soon waken with cold, even with the best of blankets. The heat-producing (or thermogenic) function of the muscles continues even when they are in a state of relative rest. One must not forget that some other organs add to the heat which the muscles produce, and the best illustration is the liver. One has only to dissect or open a rabbit, soon after it has been killed, to feel the warmth of the liver, and one may also be able to demonstrate that heat is produced by the digestion of the food in the stomach and small intestine.

Contraction of Muscle.—To avoid learning what would have to be unlearned in the course of deeper study, it should be noted here that the oxidations that go on in the body are not *exactly* comparable with those that go on in a burning fire. Thus, it is evident that the oxidations in the body go on at a much lower temperature than the true combustions of a fire or furnace. Again, while it is very useful to compare the food of the body to the fuel of the engine, since both form, along with the air, the original source of all the energy, the energy expended by a contracting muscle when it does work is not *directly* derived from the oxidation of food or fuel. The muscle is not an internal combustion-engine, as was formerly supposed. As Sir William Bayliss put it: "The muscular system is analogous to a gas-engine used to compress air into a reservoir, from which it is taken to drive, by its pressure, various machines and tools." In the first chapter of muscle-contraction, when the living threads of flesh-substance become shorter and broader, and thus do work, there is no using up of oxygen and no formation of carbon dioxide. So this is not combustion. But there is a liberation of lactic acid from the muscle fibre, and this brings about physical changes, *e.g.*, in the surface-tension, that result in contracting. It is as if the lactic acid pulled the trigger of a *shortening* spring in the muscle-fibre; but if the muscle is to return to the normal relaxation, the lactic acid must be removed. About a fifth of

it seems to be oxidised, being converted into carbon dioxide and water; and the energy furnished by the changes is sufficient to reconvert the rest of the lactic acid into its chemical precursor—a phosphate of sugar which is abundantly present in the muscle. Part of the energy takes the form of heat; the rest is changed into the potential chemical energy of the sugar. As the sugar or the animal starch (glycogen), which precedes it in the muscle, is derived from the digested food, one may say that the energy expended when the horse draws the plough comes from the corn and hay. As the carbon-compounds of the corn and hay were built up in the plant's photosynthesis by utilizing the radiant energy of the orange-red-yellow rays of the sunlight, we may say that the animal heat of the horse is transformed sunshine. If we go one step further, the sunshine is ultimately due to the disintegration of atoms, or to the destructive collisions of electrons and protons, in the sun's colossal furnace. So that is the fountain and origin of all the animal heat!

Calories.—So far then it is clear that the heat of the body is directly or indirectly due to the oxidation of the food, and the amount of heat the food can produce when oxidized in the body is theoretically the same as it produces if burnt in the air. The amount of heat is measured in terms of Calories, a "great Calorie," as it is called, being the amount of heat required to raise the temperature of a litre (rather less than a quart) of water by one degree Centigrade. As Professor V. H. Mottram puts it: it requires 100 great Calories to heat a litre of ice-cold water to the boiling point, and we can get considerably more heat by eating five ounces of lean meat.

Very important for those who feed stock, as well as for those who would dine wisely, is the question of the heat-yielding values of the different kinds of food, but we cannot do more than illustrate the point. There are three main kinds of food:—

(*a*) the *proteins*, such as the gluten of wheat, the casein of milk, the vitellin of yolk of egg, and other albuminoid substances such as those composing about one ounce in five ounces of lean meat;

(*b*) the *carbohydrates*, such as starch and sugar; and

(*c*) the fats.

Now a gramme (28·4 to an ounce) of typical protein yields 4·1 great Calories in the body, but all proteins have not the same heat-producing value; a gramme of carbohydrate yields about the same; a gramme of fat more than twice as much—9·3 great Calories. It should be noted that the living body does not manage to oxidize its protein food as thoroughly as it oxidizes the carbohydrates and fats, so that, as far as heat-production is concerned, proteinaceous food is less profitable than the others. Nevertheless it is from the proteins only that the wear and tear of the living tissues is made good.

Loss of Heat.—As we have said, heat is produced by the breaking-down (or katabolic) chemical changes that go on incessantly in the body, but the great producers of heat are the muscles and the glands, especially the big liver. The muscles of the heart, which never stop contracting, except for momentary rests between beats, must produce a lot of heat in a day. Where does all the heat go to, if only about a quarter of it is used in doing work? The answer is that most of it is lost from the skin by radiation or by evaporation, or by other forms of heat-loss; but a considerable amount is lost in respiration from the internal surface of the lungs, and everyone is familiar with the "hot breath" of a big animal. Everyone must also have noticed on a country road on a cold day that heat is lost from the horse's dung and urine, but this loss is small compared with that from the skin and the lungs.

The living body is often compared to an engine, and though the comparison soon breaks down—since the animal is a self-stoking, self-regulating, self-repairing, self-multiplying, self-guiding, and often self-conscious engine—there is this usefulness in it, that both engine and animal are arrangements for transforming matter and energy from one form to another and getting work done. But all higher animals are far ahead of, say, railway locomotives in their efficiency, that is to say, in the amount of work that they can do for a given supply of chemical energy in the form of fuel or of food as the case may be.

Of the heat produced by burning its fuel an ordinary railway engine only turns about 10 per cent. into work, the rest being wasted; but a higher animal utilizes 20-25 per cent. of the heat theoretically available from its food. It excels the engine, though it is none the less very wasteful. *How does it lose so much heat?*

Temperature of Various Animals.—The temperature of a healthy man is normally between 36·5° and 37·5° Centigrade; in fever there is a notable rise, which may be fatal. We may say that we feel cold or feel warm, but a thermometer in our mouth shows little change; and it is plainly necessary to distinguish

our *sensations* of being cold or being warm from the *actual* temperature which remains practically constant. It is interesting, however, to notice that the body-temperature falls in starvation, and sinks to below 30° at the approach of certain kinds of death. In our ordinary routine the minimum is at about 3 a.m. when the functions of the body are most quieted down. The maximum, on the other hand, is between four and five in the afternoon. This body- or blood-temperature that we are speaking about is the balance that an organism arrives at between the amount of heat produced and the amount lost. In birds and mammals it is so nearly constant for each particular species that a deviation from it points to something wrong. Hence the doctor or the veterinarian never omits to take the temperature of his patient.

Many birds have a temperature of 42° Centigrade, which would soon kill a man, and this hot-bloodedness is to be connected with several facts. (1) As everyone knows, birds are very active creatures with a highly-developed muscular system, the pigeon's muscles of flight sometimes weighing half of the whole body. (2) Birds have a very intense metabolism or chemical routine in the body; that is to say, there are very numerous chemical reactions going on per minute, far more than in a snake or a frog. (3) Birds have a very perfect non-conducting robe over their body, which checks the loss of heat, the plumage of birds excelling the pelage of mammals, fine as that often is. (4) As we shall notice later on, birds are not only hot-blooded, they are very perfectly warm-blooded—adjusting production of heat to loss with great constancy.

Among mammals, bats have the highest temperature, as we might expect in creatures with the power of flight. The lowest temperatures are found in the two egg-laying mammals, in several ways reptilian, namely, the Duckmole and the Spiny Anteater, which vary from 25°–28° C., and change very readily. Most mammals, however, have temperatures not very different from our own, thus the following figures are given by Halliburton: horse and ox, 37·5°–38°; dog and cat, 38·5°–39°; sheep and rabbit, 38°–39·5° C.

Warm-Blooded and Cold-Blooded.—People often object to technical names, and with some reason; yet we have only to look around to see that popular names are sometimes misleading, and there is a good example in these two terms—"warm-blooded" and "cold-blooded." They do not quite express what they really mean. The only "warm-blooded" living beings are birds and mammals; but no one can suppose

that a snake or lizard basking on the desert under a tropical sun has a low temperature. Fishes are mostly very cold, and all are cold-blooded, yet the big tunny common in the Mediterranean has a very distinct temperature. No backboneless animals show any sign of being warm-blooded, yet the interior of a White Ants' nest may have a temperature 25° Fahr. higher than that of the outside world. These very muscular insects produce much heat; the substantial non-conducting clay walls conserve this, and the loss is sometimes lessened by the presence of hundreds of thin-walled empty cells in the interior of the termitary. This helps us to understand why the six-foot-long Monitor lizard should have discovered that the earthen nest of one of the commonest South African White Ants or Termites is a very suitable cradle for its big eggs, which it deposits in the very heart of the remarkable edifice. The air is moist and there is central heating—both very advantageous for the development of the embryo lizards inside the eggs. Even in the bee-hive and the wasps' nest there is a demonstrable warmth, due to the insects themselves, apart from the heat of the sun. Our point is simply that a cold-blooded animal may be warm, while a warm-blooded mammal sometimes has a temperature considerably below ours or below the cow's.

The fact is that cold-blooded animals are those whose body-temperature (measured by a thermometer placed in the mouth, or the armpit, or some such place) is changeable, tending to approximate to that of the surrounding world; whereas warm-blooded animals have an almost constant temperature, day and night, year in and year out. Hence the use of the technical terms—*poikilothermal* for cold-blooded (*poikilo*, changeable; *thermal*, warmth); and *stenothermal* for warm-blooded (*steno*, constant; *thermal*, warmth). For warm-blooded, some say *homoiothermal* (*homoio*, uniform; *thermal*, warmth).

When a mammal is losing much heat on a frosty day, the blood becomes a little colder and as it flows through a part of the brain (the heat-regulating centre) the lowered temperature affects the nerve-cells. Whereupon, in accordance with their pre-disposed susceptibilities and linkages, they send messages to the muscles commanding them to produce more heat, as they forthwith proceed to do. Other messages pass to the blood-vessels of the skin commanding them to contract—as when we become pale with cold—and this reduces the loss of heat.

Conversely, on a very hot day, the automatic regulation works equally well; messages pass to the mammals' sweat-glands, commanding profuse perspiration, and the evaporation of the sweat from the surface lowers the temperature. Further, the breathing movements are quickened, as we see in the panting dog, and that means cooling. Again, in the heat of day many of the birds and beasts keep very quiet, which lessens the production of heat by the muscles. As birds do not sweat, the automatic cooling is more difficult in their case; and many of them seek cover and shade when it is very warm.

There are not many fitnesses or adaptations that work with more efficiency than this automatic heat-regulating (or thermotaxic) arrangement; and its perfection is accentuated when we notice that it is often far from ready at birth. Thus the nestling bird is still very imperfectly warm-blooded, and soon becomes fatally cooled if the mother-bird does not return. The young bird is climbing up its own genealogical tree, for birds evolved from reptiles, and reptiles are cold-blooded. Similarly in some very young mammals, especially those born naked, the heat-regulating arrangement is not fully developed; so it is essential that they should be protected by the mother or in a nest. This is true of human babies born very prematurely; they need an incubator.

A few mammals remain throughout life imperfectly warm-blooded, and it is interesting to notice that they have become the hibernators, like hedgehog and dormouse, to which we referred in our "Biological Walk" in the November, 1930, issue of this JOURNAL (p. 759).

Use of Animal Heat.—We have kept this question to the end because it seems clearer to begin by laying emphasis on the fact that the production of heat is a necessary consequence of the disruptive or chemical changes that go on in the body—just as necessary as the production of heat in a test-tube when certain reactions take place. Even plants may produce heat, as has been shown in the crowded flowers of the Calla Lily or of the Cuckoo Pint within their spathe. When fermentations are going on, as in germinating seeds or heating hay-ricks, there is a production of heat. This is often associated with the activity of microbes, and everyone is familiar with the steam rising from an opened dung-heap. The production of heat is a general concomitant of the process of living, but it has not been much studied except in mammals.

In some insects, which vie with birds in their activity, the temperature of the body may be several degrees above that

of the surrounding world, but in most of the lower animals the heat seems to be lost almost as soon as it is produced. In a few cases only, like the tunny already mentioned, does the heat accumulate sufficiently to be appreciable. Only in birds and mammals, as we have explained, is there a device for keeping up a constant temperature. Why should this conduce to a more effective life? The answer is that certain chemical processes proceed more quickly and easily when considerable heat is available, and that arrangements securing a constant high temperature make the chemical processes go on not only more briskly, but more smoothly. Animal Heat helps the animal to make the most of its energy.

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CULTIVATION OF THE SUGAR BEET CROP

THREE YEARS' INVESTIGATIONS OF THE EFFECTS OF SPACING

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Introduction.—The introduction of a new crop into farm practice raises a primary need for reliable information on numerous points, such as varietal characteristics, cultural treatment and manurial treatment. With a crop like sugar beet, it is necessary, moreover, that this information shall cover not only the yield, but also the composition of the crop and, in particular, its sugar content.

Practical guidance on these points must be sought by means of field tests conducted throughout the areas in which the beet is to be grown, as experience gained elsewhere is liable to be an uncertain guide. Whether these tests deal with varieties, cultural methods, or manuring, the results obtained at any one centre can have but more or less limited application until confirmed by repetition elsewhere. This statement may possibly be truer of the results of manurial than of cultural experiments. To obtain really reliable information on the question of manuring the sugar beet crop, the writer believes that only a scheme of well-planned experiments, on a national or equally wide basis, of which the results could be subjected to statistical criticism, would be of much value and likely to lead to definite conclusions. Such an opinion seems to be justified by the diverse results obtained during two years' of manurial experiments carried out in various counties.

Of the several factors above mentioned, the trials under notice were concerned during the past few years with the

study of the effect of one cultural factor, the spacing of the plants, upon the yield and sugar content of sugar beet grown on, and in the neighbourhood of, the Harper Adams College Farm, which is situated in the north-eastern portion of the county of Shropshire. Other factors were also brought under observation, but were studied less closely. It is with spacing, therefore, that we are primarily concerned in this article, which summarizes the work done during the three seasons, 1927-29.

First Year (1927).—The experiments of this year were planned to cover spacing within and between the rows, sub-soiling, and planting on the ridge and flat. The experimental area was laid down as shown in Fig. 1, giving quarter sections as follows :—

Sub-soiled, ridge sown.
" flat sown.
Not sub-soiled, ridge sown.
" " flat sown.

Each of these quarter sections was further divided into 20 plots to provide all possible combinations of the following distances between the rows and of hoeing :—

Width between the rows : 16, 18, 20, 22 and 24 inches.
Width of hoes used : 4, 6, 8 and 10 inches.

It will be seen that the whole scheme comprised 80 plots, divided into four groups of 20 each, so far as the spacing test was concerned. The area of each small plot was approximately one-twentieth of an acre.

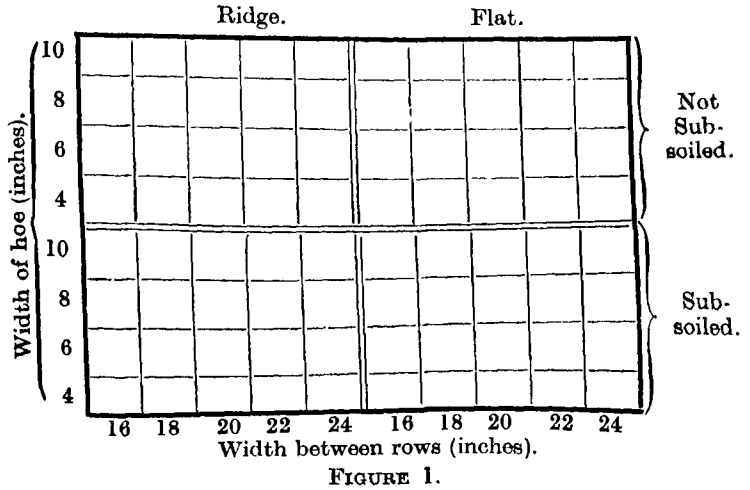

FIGURE 1.

Lifting was carried out early in November by removing 10 half-chain lengths from each plot for gross weight. From

these, 50 beet were taken at random for estimating the dirt tare and sugar content.

The experiment was laid down on a loamy sand, and, except for those under examination, all the factors were kept as constant as possible. The results are later discussed in detail.

Second Year (1928).—In this year attention was concentrated entirely on the question of spacing and the arrangement was modified accordingly, the arrangement being shown in Fig. 2.

Spacing between plants in inches.				Width of Rows. inches.
6	4	10	8	18
8	6	4	10	21
10	8	6	4	24
4	10	8	6	15
8	6	4	10	21
10	8	6	4	24
4	10	8	6	15
6	4	10	8	18
10	8	6	4	24
4	10	8	6	15
6	4	10	8	18
8	6	4	10	21
4	10	8	6	15
6	4	10	8	18
8	6	4	10	21
10	8	6	4	24

FIGURE 2.

It will be noted that four different spacings between the plants (4, 6, 8 and 10 inches) were used and similarly four different spacings between the rows (15, 18, 21 and 24 inches), the latter being repeated four times, the whole thus forming a

16-plot test in quadruplicate or 64 plots in all. The soil was a loamy sand.

In order to secure greater accuracy, a much smaller size of plot was used than in the previous year so that the whole of the necessary cultivating, sowing, etc., could be carried out by hand labour. The total area of the 64 plots was about a ¼ acre, giving an area of 1/256 acre per plot.

The desired spacings between the plants in the row were obtained by the use of marked rods laid alongside the rows, the use of standard hoes, as in the previous year, being insufficiently precise for small-scale work. The whole area was sown on the flat and received uniform manurial treatment.

Each plot consisted of seven rows, the outer ones of which were discarded at harvest time. The number of plants per plot varied from 90 on the widest spacings to 250 on the narrowest.

Harvesting was carried out by lifting 50 beet at random from each plot for estimation of dirt tare and sugar content. Of these the tops and crowns were separately estimated. The remainder of each plot was pulled, washed and weighed. It was possible in this way to obtain information on the accuracy of the usual procedure (by taking 50 beet at random) for the estimation of dirt tare. The results of the 1928 experiment are reviewed later.

Third Year (1929).—In design and execution, the experiments of this year were somewhat similar to those of the previous year, except for difference in the soil and the number of spacings, as shown in Fig. 3.

It will be noted that in this year five different spacings (12, 15, 18, 21 and 24 inches) between the rows were included, whilst the four spacings within the rows were taken at 4, 7, 10 and 13 inches. These spacings not only were intended to cover the range likely to be used in practice, but also to give information on the effect of going above and below these limits. The test was again in quadruplicate, giving 80 plots. The total area of the plots was about ¾ acre, each individual plot being, therefore, about 1/100 acre. Each plot contained 10 rows, of which the centre six were harvested and the remainder discarded.

The experiment was conducted on a deep sandy soil, somewhat coarser and ligher than the soils of the two previous seasons. Harvesting was carried out by pulling, topping, washing and weighing all the beet from each plot. Sampling for dirt tare was carried out as in the previous year.

Spacing between plants in inches.				Width of rows. inches.
4	7	10	13	15
13	4	7	10	12
10	13	4	7	21
7	10	13	4	18
13	4	7	10	24
4	7	10	13	12
10	13	4	7	18
4	7	10	13	24
13	4	7	10	21
7	10	13	4	15
4	7	10	13	21
7	10	13	4	24
13	4	7	10	18
10	13	4	7	15
7	10	13	4	12
13	4	7	10	15
7	10	13	4	21
10	13	4	7	12
4	7	10	13	18
10	13	4	7	24

FIGURE 3.

Meteorological Conditions.—A statement of results would be incomplete without reference to the meteorological conditions prevailing during the three seasons. Tables have been compiled consisting of data abstracted from the daily readings. These, for reasons of space, cannot be printed here in full, but are summarized below.

The weather during the growing periods of the three seasons 1927, 1928, 1929 offered great contrasts. In 1927, the rainfall was moderate in spring and higher in the summer. The

average daily hours of sunshine were never high, while the accumulated day degrees were approximately equal to those of the corresponding months in 1928 and 1929.

The growing season of 1928 was on the whole less rainy. Except for the months of April, May and June, the accumulated day degrees per month were only slightly lower than in 1927. The daily sunshine average was, however, higher, except in the months of April and May.

In 1929, the rainfall was low, and the number of days on which heavy rain fell were few. The combination of these two factors, coupled with the many hours of sunshine, led to the wilting point being frequently reached on the narrower spacings. Such rain as fell was usually so slight that it dried away in a short time. In interpreting rainfall figures, not only the total rainfall figures but the quantity which fell at any one time should be taken into account.

As experience accumulates, it seems to become more and more evident that meteorological conditions have a profound effect on the yield and sugar content of the crop. In support of this statement, the average sugar content figures for the three years are interesting :—

1927	16·3 per cent. sugar.
1928	17·4 ,, ,,
1929	18·2 ,, ,,

In each case it seems evident that the sunshine records are closely correlated with the sugar content.

Agricultural Conditions.—*Ploughing.*—In all three seasons, the fields were deeply ploughed, and in 1927 the part indicated in Figure 1 was also sub-soiled.

Manuring.—In all cases farmyard manure had been applied to previous crops. The usual practice of applying a balanced mixture of artificial fertilizers was followed.

Seeding.—This was at the rate of about 20 lb. per acre, applied in the first year with hand and corn drills, and in the second and third years with hand drills. It may be of interest to anyone contemplating sugar beet experimental work to note that it is imperative to seed heavily and to drill each row at least twice to get an even distribution of seed.

Further Cultural Operations.—Only in the first year were any succeeding cultivations carried out by horses, and even then, in the 16-in. drills, hand labour had to be used. Otherwise, all the subsequent operations were carried out by hand.

Results of Experiments : Variation in the Distance between the Rows.—The summarized results of the three seasons can be examined in Table I :—

TABLE I

1927			1928			1929		
Distance between rows in.	Yield (Tons per acre)	Sugar Content p.c.	Distance between rows in.	Yield (Tons per acre)	Sugar Content p.c.	Distance between rows in.	Yield (Tons per acre)	Sugar Content p.c.
16	14·96	16·2	15	13·67	17·33	12	11·34	18·24
18	13·46	16·4	18	13·28	17·35	15	11·23	18·21
20	12·01	16·0	—	—	—	18	11·19	18·19
22	11·96	16·6	21	13·03	17·43	21	10·73	18·22
24	11·49	16·6	24	12·63	17·34	24	10·64	18·15

It will be observed that, in all three cases, a marked and significant increase in tonnage takes place with decreasing distance between the rows. This is most marked in the season 1927, and amounts to a difference of 3½ tons per acre between the widest and narrowest spacings.

For the Season 1927, a statistical analysis of the results indicates that the differences between the resulting yields on the 16-in. and 18-in. rows and those on the wider distances may be taken as definitely due to the difference in spacing. The differences between the 20-in., 22-in. and 24-in. spacings may be due to chance, and cannot therefore be regarded as significant. The conclusion that the highest yields are to be expected on the narrower rather than the wider spacings was corroborated by numerous experiments in adjacent counties.

In the Season 1928, the differences between the 15-in. and the 21-in., the 15-in. and 24-in., and the 18-in. and 24-in. spacings were significant. It is interesting to note that, in this season, the weights of crowns and tops were 1·5 tons and 20·2 tons per acre respectively. No significant differences between the weights of tops and crowns from different spacings between the rows were evident.

In the Season 1929, the results verify those of the two previous seasons and show a similarly increasing yield of roots with decreasing distance between the rows. There is little doubt that the results for this season would have been more strongly marked had the rainfall been higher, the effects of the drought falling most heavily on the narrower spacings. Frequently the wilting point was reached on the narrower

spacings, and this must have contributed to a substantial reduction in the yields.

Summarizing the three years' work, it seems clear that farmers aiming at high yields should grow their beet closely spaced in the rows. The question of degree must be left to the grower and will be influenced somewhat by the kind of soil and its freedom from weeds, especially those with strong rooting systems. On light soils, the topography or nature of which conduces to drought, spacings wider than 18 in. are probably advisable.

As a result of the three years' investigations a distance of 18 in. seems to be indicated as the optimum spacing, and it is interesting to note that many farmers in the West Midlands now adopt this distance.

Effect on Variation in Distance between Plants in the Row.—Table II shows the collected results on this point for the three years.

TABLE II

	1927		1928		1929		
Hoes. in.	Washed Beet (Tons per acre)	Distance between plants. in.	Washed Beet (Tons per acre)	Sugar per-cent.	Distance between plants. in.	Washed Beet (Tons per acre)	Sugar per-cent.
4	12·63	4	13·43	17·41	4	10·63	18·08
6	12·97	6	13·08	17·35	7	10·89	18·22
8	12·99	8	13·05	17·33	10	11·54	18·28
10	12·49	10	13·05	17·45	13	11·05	18·23

It is an exceedingly interesting fact that, unlike the effects of differing row widths, varying distances between the plants have no significant effect on the yield, at any rate up to a distance of 10 inches. This fact is borne out by the results of all three years except in one instance, namely, the difference of the yields between the 4-in. and 10-in. distances in 1929, when a significant difference is shown. It is felt here that this difference would not have occurred but for the abnormality of the season when the plants on the narrow 4-in. spacing suffered severely from the drought.

Reference to the 1929 figures, and also to those in Table III, suggests that, for distances above 10 in. apart, a diminution in yield takes place.

For purposes of comparison a summary is given in Table III of results obtained in experiments at two centres in Staffordshire, carried out by the County Advisory Staff.

TABLE III—STAFFORDSHIRE COUNTY COUNCIL EXPERIMENTS, 1927

		Himley	*Enville*	
Narrow singling	7-8 in. . .	12·32	13·25	Washed beet, tons per acre
Medium ,,	9-10 in. . .	12·68	13·55	
Wide ,,	11-12 in. . .	11·71	12·53	

The conclusive results of the three years point to the fact that narrow spacings between the plants give no advantage, at any rate up to a width of about 10 in.

These conclusions have considerable practical importance, since singling, being a hand operation, is one of the most tedious phases of beet cultivation and, at the same time, one of the most difficult to regulate. Rowing up, on the other hand, is mechanical, and it is merely a matter of contrivance to obtain narrow rows.

Effect of the Area per Plant on the Yield.—By combining the results for distance between the rows with those for width apart in the row, we get the effects of the area per plant as shown in Tables IV and V for the years 1928 and 1929.

TABLE IV—1928

Spacing (in.)	Area (sq. in.)	Washed Beet (Tons per acre)	Sugar percentage	Sugar (Tons per acre)
15 × 4	60	14·14	17·19	2·43
18 × 4	72	13·55	17·34	2·35
21 × 4	84	12·94	17·54	2·27
15 × 6	90	13·97	17·38	2·43
24 × 4	96	13·11	17·29	2·27
18 × 6	108	12·55	17·32	2·17
15 × 8	120	13·46	17·40	2·34
21 × 6	126	12·81	17·34	2·22
24 × 6	144	12·99	17·36	2·26
18 × 8	144	13·40	17·38	2·33
15 × 10	150	13·12	17·33	2·27
21 × 8	168	12·96	17·26	2·24
18 × 10	180	13·61	17·37	2·36
24 × 8	192	12·37	17·28	2·14
21 × 10	210	13·41	17·59	2·36
24 × 10	240	12·05	17·41	2·10

The rather surprising conclusion is evident that, despite the great difference in area per plant, there were no significant differences in yield per acre in either year, except that (in 1928) the lowest returns were obtained on the maximum area per plant, and the highest on the minimum area. There is no relation either between the area (and probably the weight) per plant and the sugar content.

TABLE V—1929

Space per plant (Sq. in.)	Dimensions (in.)	Average of 4 plots (Tons p. acre)	Sugar percentage	Sugar (Tons per acre)
48	12 × 4	10·95	18·14	1·99
60	15 × 4	11·14	18·23	2·03
72	18 × 4	11·33	18·49	2·10
84	21 × 4	9·95	17·92	1·78
84	12 × 7	11·45	18·14	2·08
96	24 × 4	9·80	17·88	1·75
105	15 × 7	10·63	18·18	1·93
120	12 × 10	12·27	18·23	2·24
126	18 × 7	10·72	18·11	2·37
147	21 × 7	11·06	18·28	2·02
150	15 × 10	11·28	18·35	2·07
156	12 × 13	10·69	18·30	1·96
168	24 × 7	10·59	18·31	1·94
180	18 × 10	11·65	18·10	2·11
195	15 × 13	11·87	18·10	2·15
210	21 × 10	11·15	18·29	2·04
234	18 × 13	11·08	18·41	2·04
240	24 × 10	11·34	18·37	2·08
273	21 × 13	10·75	18·23	1·96
312	24 × 13	10·85	18·43	2·00

The returns for 1929 suggest similar conclusions. Increased area per plant seems to be balanced by an equivalent increased size of the plant.

Effect of Spacing on Sugar Content.—No general relationship between sugar content and spacing has been evident. There seemed to be some suggestion that the sugar content decreased with increasing distance between the rows in 1927, but this was not verified in 1928 and 1929.

The reasonable deductions seem to be that the rows should be spaced at 18 in. and the plants in the row at 9 in.

Relative Importance of Weight per Acre and Sugar Content.—On the present basis of agreement between the factories and the farmers, payment is made both on the net weight of beet supplied and on the sugar content of the beet. Improvement in either increases the returns. The question at once arises, therefore, as to how far the farmer has the control of these factors.

The cultural experiments dealt with above suggest one way, at least, in which the farmer may confidently look for increasing the yield of beet. Other factors, also, such as proper manuring, freedom from gaps, cleanliness of land, &c., all contribute to higher yields per acre.

The control of sugar content presents more difficult problems. The farmer, except in the choice of variety, has practically no control of the sugar content. The whole matter is but imperfectly understood, but it is probable that sunshine, temperature, and variety are the most important factors. Some investigations have furnished evidence that manuring also may have some slight influence, excess nitrogen and lack of potash both tending to decrease the sugar content. On the whole, therefore, growers would seem to be well advised to concentrate on growing the highest tonnage per acre possible, leaving the sugar content to the chance of the season. This generalization may require some modification, however, in the case of growers living far from the factory; the consequent heavier freightage charges may make it desirable to choose a variety giving a higher sugar content with a lower yield.

Other Information Derived from the Experiments.—*Influence of Sowing on the Ridge versus Flat.*—The point was investigated in the year 1927 only. The results distinctly favoured the ridge, where the weight was 13·41 tons per acre of washed beet compared with 12·14 on the flat. This was supported by results in the same year from Staffordshire and Shropshire. For various reasons, but chiefly to the introduction of time-saving machines, most of the beet in the West Midlands is now grown on shallow ridges or else on the flat. On the whole, the high ridge does not seem suitable for beet, because of the difficulty of controlling attacks from Springtails, and of keeping the beet adequately covered to prevent green crowns.

Influence of Subsoiling.—The scope for improvement by subsoiling must naturally vary on different soils. Up to the present, there are no exact criteria for predetermining whether a particular soil may need subsoiling or not. In the case of the 1927 experiments the results were inconclusive, giving an average of 12·98 tons per acre on the non-subsoiled and 12·57 tons on the subsoiled part.

Yield of Tops and Crowns.—Determinations of these quantities were made in 1928 only. The yield of crowns was about 1·5 tons per acre, with a sugar content of only 10 per cent. In the same experiment, the yield of green, unwilted tops was about 20 tons per acre. It is interesting to note that the weights of tops on various spacings between the plants showed significant differences, while the weights on the different row spacings did not.

From an analysis of the tops and crowns it was concluded that ploughing these in would be equivalent to a dressing of about 11 tons of farmyard manure per acre.

Dirt Tare.—Very considerable variation was found in the dirt tare of samples of 50 beet. In the experiment of 1928, when all the pulling was carried out uniformly during dry weather, the dirt tare varied in different samples from 9 to 41 lb. per cwt. It is probable that variation in the degree of fanging of the roots accounted for the very considerable variations in dirt tare on different plots.

Summary.—(1) The evidence of the three years' (1927-28-29) experiments in sugar beet growing shows a very decided advantage in favour of narrow spacing of the rows. This is corroborated by external evidence from county experiments. While practical considerations possibly rule out 16 inches at present, it seems that expectation of consistently high yields can only be realized by narrow spacing.

(2) The results of the three years' experiments do not show any significant differences in the yields of roots grown on different spacings in the row. The evidence shows that just as high a yield is obtained with 10-in. as with any smaller spacing. Above 10-in. the yield shows a decrease.

(3) The effect of variation in the number of plants per acre (otherwise expressed as area per plant) has no corresponding response in yield or sugar content. Almost equal yields were obtained when the number of plants was small as when it was large. A spacing of 18 in. × 9 in. seems suitable for Midland conditions.

(4) On fields where the soil has no tendency to form hard lower layers, the necessity for subsoiling was not apparent. The crop, however, is one for which deep cultivation is essential.

(5) Yields of sugar beet grown on the ridge and flat in 1927 showed an advantage in favour of growing on the ridge. Possibly the greater risk of insect attack may over-ride such advantages and make growing on the flat preferable.

(6) The yield of crowns bears no relation to spacing.

(7) The yield of tops shows a definite relationship with spacing. Significant differences in yield were apparent in 1928 with varying spacing in the row but not between the rows. This is in the opposite direction to the results stated above for the variation in yield of roots.

(8) Meteorological conditions undoubtedly play an important part in control of yield and sugar content.

(9) No general relationship between sugar content and spacing is evident.

(10) Under the existing agreements with the factories, most growers are advised to try to obtain a higher tonnage rather than a higher sugar content. This advice may need some modification for growers living a great distance from the factory.

The writer wishes to record his warm appreciation of the services of numerous colleagues (both in the College and in the neighbouring counties) who contributed in no small degree to the satisfactory conduct of the various experiments.

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WEEDS OF GRASS LAND—II*

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Weeds Related to Soils.—During the last twenty years progress in our knowledge of grass land and its associations and improvement has increased at a great rate, and a few points of interest and value may suitably be mentioned here. It is, for example, useful to bear in mind that many grassy heaths have probably been developed from *Calluna* heaths, the *Calluna* (ling or heather) having been suppressed by rabbits and grazing sheep. Indeed, it is remarkable that in the eastern counties the term "heath" is still applied to areas, even on the Chalk, that are now pastures on which true heath plants are no longer found. The result of grazing by rabbits and sheep is well established.[1] It would seem also that mowing before the seed is ripe has been effective in reducing heather on Newmarket Heath. Further, Farrow suggests that the influence of rabbits was sufficient to bring about the replacement of the Scots pine by bracken, and thence leading to a grassland period on these heath lands.

The effect of rabbits and sheep has also been studied by Tansley and Adamson[2] on English chalk grass lands, and there seems no doubt that changes occur according to the extent of the grazing; these authorities observe that "the great bulk of the English chalk grass land is a community fixed and to

* The first article appeared in the issue of this JOURNAL for December, 1930, p. 871.

[1] The Ecology of the Vegetation of Breckland, E. Pickworth Farrow; *Jour. Ecol.*, XIII, 1925.

[2] Studies of the Vegetation of the English Chalk, A. G. Tansley and R. S. Adamson; *Jour. Ecol.*, XIII, 1925; XIV, 1926.

some extent modified by continuous grazing," which, indeed, seems to be the one factor that inhibits the eventual passing of such areas into chalk heath characterised by *Calluna* (heather or ling), *Erica* (heath), etc., and thence into woodland.

An investigation by Salisbury[3] led him to the conclusion that "the main factor which is responsible for the incidence of species is the reaction of the soil, which is one of the several important factors that govern the distribution of plants in the wild state."

Hopkinson[4] has shown that, on the Bunter Sandstone of Notts, land that is going out of cultivation, *e.g.*, arable land in second-year grass (third year of rotation), has been observed to contain 33 per cent. of the species found on grass heaths. *Rumex acetosella* (sheep's sorrel) is generally dominant in the first few years, and is followed by *Luzula campestris* (field woodrush), *Agrostis vulgaris* (bent), *Holcus mollis* (creeping soft grass), etc., while arable weeds disappear. *Deschampsia flexuosa* (wavy hair grass) later becomes dominant and forms the characteristic tussocky turf, *Senecio jacobaea* (ragwort) often appearing also.

On the chalk downs Anderson found[5] that the most deeply-rooted species among the flora included *Ononis spinosa* (rest-harrow) and *Poterium sanguisorba* (burnet)—both of which may run to a depth of 3 ft. The average depth of 50 characteristic species was 4–8 in. On these soils the largest average water supply was furnished by the surface 3 in. of soil.

In a later discussion of the flora of the chalk downs Anderson has shown[6] that the bulk of the feeding roots are usually developed at a depth of 16–27 in., though as already observed the average working depth of the feeding roots of some 50 species was 4–8 in. only. Further, even on such soils, leaching of calcium carbonate may proceed so far that in one case it was reduced in the top 3 in. to less than 0·02 per cent. (whereas at 9 in. depth 82 per cent. of the dry weight consisted of carbonates). Such a fact may well explain the appearance of ling (*Calluna vulgaris*). On these chalk soils, *Brachypodium pinnatum* (tor grass) seems to be spreading extensively on the South Downs, and tends to suppress other herbage. Evaporation of moisture also leads to dryness of the top soil, and this tends to the presence of plants that are deep-rooted and can withstand drought. Sheep and rabbits keep the herbage closely grazed, so that few tall-growing plants are seen. Among common weeds are *Carex flacca* (glaucous sedge), *Thymus serpyllum* (wild thyme), *Linum catharticum* (purging flax), *Poterium sanguisorba* (burnet), *Galium verum* (lady's bedstraw), and many others.

[3] The Incidence of Species in Relation to Soil Reaction, E. J. Salisbury: *Jour. Ecol.*, XIII, 1925.

[4] The Ecology of the Bunter Sandstone, J. W. Hopkinson: *Ibid.* p.130.

[5] The Water Economy of the Chalk Flora, V. L. Anderson: *Jour. Ecol.*, XV, 1927, p. 72.

[6] The Flora of the Chalk Downs, V. L. Anderson: *Sci. Progress*, Jan., 1928, p. 444.

Stapledon and Hanley[7] indicate that on acid soils and in smoky districts neglected grass is chiefly composed of bent, while on the light sandy soils *Holcus mollis* (creeping soft grass) takes possession of large patches, and on the poorer soils such weeds as yarrow, field woodrush, earth-nut, Yorkshire fog and sheep's sorrel are common; on peaty soils there is commonly a rank growth of coarse grasses and weeds, and *Agrostis alba* (fiorin) is difficult to keep in check; on the peaty sands ragwort is one of the characteristic weeds; on unimproved and undrained damp soils rushes and the common sedge (carnation grass) grow freely; while "old grass land impoverished by mowing year after year without manures is often characterized by the presence of yellow rattle, ox-eye daisy, sorrel dock (*Rumex acetosa*), Yorkshire fog and soft brome.

It has been found[8] also that the weed flora of pasture plots was small and in marked contrast to hay plots.

It may be said that within broad limits the following species of grassland weeds are related to the types of soils mentioned:—

Damp Soils	*Neglected and Poor Soils*	*Heavy Land*
Rushes	Yorkshire Fog	Horsetails
Certain Sedges	Quaking Grass	Coltsfoot
Horsetails	Sterile Brome Grass	Knapweed
Cotton Grasses	Ox-eye Daisy	Ragwort
Silver-weed	Knapweed	Buttercups
Tussock Grass	Yellow Rattle	Dandelion
Certain Mosses	Dyer's Green-weed	Silver-weed
Cowslip	Rest Harrow	Wild Onion
Butter-bur	Sheep's Sorrel	Bent Grasses
Lady's Smock	Ragwort	Wild Carrot
Meadow Sweet		
Ragged Robin		
Coltsfoot		
Orchids		
Wild Onion		

[7] Grass Land, Its Management and Improvement: R. G. Stapledon and J. A. Hanley, 1927.

[8] *e.g.*, A Botanical Study of Pasture Plots, E. Wyllie Fenton: *Ann. of Appl. Biol.*, XVII, 3, 1930, p. 522.

Calcareous Soils	*Soils in Need of Lime*	*Good or Loamy Soils*
Burnet	Sheep's Sorrel	Buttercups
Chicory	Ox-eye Daisy	Spear Thistle
Viper's Bugloss	Bracken	Coltsfoot
Stemless Thistle	Foxglove	Stinging Nettles
Wild Thyme	Gorse	Dandelion
Erect Brome Grass	Broom	Mouse-ear Chickweed
Tor Grass	Heather	
	Heaths	

It must not, however, be assumed that because certain of these weeds are found they specifically indicate the character of the land ; the above list is quite general and suggestive rather than arbitrary. Individual species may occur on a soil on which they are not usually plentiful, but may not be at their best, being more certainly characteristic of a different soil type. The stemless thistle, for example, may possibly be found on a soil rather deficient in lime, though it occurs at its best and in greatest profusion on calcareous soils.

General Methods making for Improvement.—When we come to consider the various factors that may be expected to make for the improvement of grass land, we may find that certain of them are already in action, but need others to be introduced if the best influence is to be ensured. Grazing may be efficient, as far as it is possible, but draining may be needed ; drainage may be satisfactory, but lime and fertilizers may be wanting ; or drainage, lime and fertilizers may be attended to but grazing be so badly managed that the possible benefits may be missed. A good sole, comparatively free from weeds, can be best assured by concurrent attention to a number of details. These may be briefly considered in turn.

Drainage.—It has been long recognized that farm land of all types must be effectively drained if it is to produce food crops, whether on grass or arable land. In recent years widespread attempts have been made, and are continuing, to improve the general " tone " of drainage throughout the country, both by arterial and field drainage, and the Land Drainage Act of 1930 represents a further attempt to bring about a much-needed improvement. Without satisfactory drainage the soil lies too damp, ineffectively aerated, unfit for the proper functioning of the roots of plants or the utilization of such lime and fertilizers as may be employed. Further, one of the needs in regard to grass land is earliness in the spring. Damp, under-drained grass land, however, is commonly unsuitable for grazing in the

early months of the year and in the autumn and winter, such land being late rather than early. Effective drainage, if it be only by means of the mole outfit, will soon add considerably to the extension of the grazing season, and prove more healthy for the grazing stock—an additional reason for attending to the drainage when attempts are being made to secure an early bite.

The subject need not be elaborated here ; it may suffice to say that many weed species are found in great plenty on wet or damp grassland areas, from which they are likely to disappear—at any rate in large part—once the improvement due to drainage sets in. The high quality of much good low-lying grass land depends very largely on the adequacy of the drainage. Moisture is highly necessary for the successful growth of grass, but waterlogging is very injurious. On the other hand, in some instances much improvement may be brought about by the use of lime and phosphates, followed by sound grazing, without the necessity of further draining—the lack of percolation of water being largely due to bad management. Lime, phosphates and close grazing may alone lead to immense improvement. There are, however, instances where lime and basic slag or mineral phosphates do not work well together, and the use of lime may be of little value if basic slag is given.

Liming.—Soils of the peaty and acid types cannot be expected to improve as they should, following effective drainage, unless the acidity is overcome by the use of lime. In general, it is likely that low-lying, damp or wet land will need lime following the drainage operation. Soils of all kinds, however, may usefully be tested for lime content before a decision as to liming is taken. It is widely recognized that a very large proportion of our grass land would be improved by liming—even some soils overlying the Chalk, where the surface lime has been carried rather low for the use of many surface-rooting plants.

Many experiments, including those at Rothamsted, have indicated the great value of liming. As much as a generation ago the Rothamsted experiments had shown the striking effect of lime on grass land, lime producing a considerable increase in crop on the average of the first crops for three years; there was also " a great increase in the proportion of leguminous plants." At Cockle Park the application of lime was found considerably to increase the yield of ribwort, but considerably to reduce the percentage of bent and Yorkshire fog. Drained grass land that has been limed is likely to contain a far greater

variety of species of herbage than similar land undrained and unlimed, while the species will be more nutritious and more productive. It may, perhaps, be said that almost all grass land would be the better for an occasional dose of lime, say 10 cwt. per acre every four years; some of the acid soils on which "mat" is obvious, however, need a fairly heavy dressing (up to 2 tons) at the outset; and there are some types of land that do not necessarily require liming.[9]

A recent report[10] discusses plants of grass land in relation to soil acidity, and it was remarked that the least acid soils were grazed best.

It is now well recognized that liming is more or less a specific remedy, over a number of years, against bracken, sheep's sorrel, ox-eye daisy, and some other weeds, especially if carried out in conjunction with judicious manuring and grazing.

Fertilizers.—Judicious manurial treatment must be considered with drainage and liming. Just as the use of fertilizers may miss a big part of the benefit if the amount of lime present is inadequate, so may draining and liming be much less effective if not followed up by manuring. In the words of Stapledon and Hanley: "A good herbage will not grow on land in bad condition, however assiduously the bad plants are uprooted." Manuring has a very great effect on the composition and quality of the herbage; this has been conclusively proved by many experiments and much investigation, and many practical farmers have long since proved it for themselves.

Permanent grass mown year after year for hay without being manured may not show a great falling off in quantity of crop, but the herbage will become steadily inferior in quality, and prominent among it are likely to be knapweed, yellow-rattle, burnet, Yorkshire fog, ox-eye daisy, sorrel, hawkbit, ragwort, etc.

It is essential that manurial treatment should not be one-sided; while the present-day intensive treatment of grass land with nitrogen, for purposes of close grazing, is quite sound, it must be accompanied by care that phosphates and potash are present in sufficient quantity, this depending very much upon the soil type. If ample minerals are present, nitrogen may be used frequently in small quantities, and if the repeated flush

[9] Further information on liming will be found in *Grass Land*, Stapledon and Hanley, 1927; The Ministry's Bulletin No. 3, *The Improvement of Grass Land* (8d. post free); Leaflet No. 170, *The Use of Lime.*

[10] The Distribution of Pasture Plants in Relation to Soil Acidity and other Factors, W. R. G. Atkins and E. Wyllie Fenton: *Sci. Proc. Roy. Dub. Soc.*, Vol. 19 (N.S.), 46, October, 1930.

of herbage is regularly grazed off, or mown, an improvement in the grass land, with a reduction in the weed flora, may be anticipated. Nitrogen alone is very unsatisfactory; nitrate of soda appears to tend to an increase of weeds and coarse grasses in the greater bulk of hay, but to a reduction in clovers; sulphate of ammonia, on the other hand, encourages sheep's fescue, bent and sheep's sorrel; phosphates and potash alone encourage clovers, but do not suppress sorrel and yarrow; lack of potash has led to an increase in knapweed, yarrow, plantain and buttercup; superphosphate applied alone continuously is possibly as exhausting as nitrogen alone; basic slag on "slag land" notoriously effects a remarkable improvement of the herbage, encouraging clovers and incidentally reducing the percentage of weeds and grasses present.

Investigations in 1927 in connexion with trials[11] on the improvement of grass land by close sectional grazing, nitrogenous manuring, etc., indicated that the only weed species that showed signs of increase under the new system was yarrow. The inferior grass, Yorkshire fog, showed very considerable active growth during the whole season. There seems some tendency for clover to be reduced by repeated doses of nitrogen and close grazing, but if this is not carried too far, and the autumn-spring herbage is increased, then the general effect is valuable.

Harrowing.—Emphasis needs to be laid on the real value of heavy drag or disc harrowing of much of our grass land before it is limed and manured. Sour, mossy, matted or foggy grass land requires the surface to be opened up to air and moisture, and many progressive farmers do not hesitate to treat such land somewhat roughly as a beginning of the improvement. This enables lime and fertilizers to exercise their full effect and gives wild white clover a chance to secure a firm footing.

Clearing Scrub, etc.—In a good many cases neglected grass land rapidly becomes rough with scrubby thorns, bushes and brambles; these need attention when improvement is undertaken. They may be grubbed or even cut off close to the ground and thereafter cut as often as any fresh growth appears; subsequent treatment (manuring and close grazing) will result in their being kept in check.

Wild White Clover.—Given efficient drainage, harrowing, lime and fertilizers, it is probably true to say that the securing of a good stand of wild white clover—sowing if need be—will

[11] *The Intensive Treatment of Grass Land*, Rt. Hon. Lord Bledisloe, K.B.E., 1928.

have a better effect in keeping down weeds of grass land than any other single item, so long, at least, as grazing is well managed. The value of wild white clover in reducing weeds has been emphasized many times by those well qualified to speak with authority. It is clear that as the proportion of clover is increased "other herbage" must decrease, and this decrease applies to weeds as well as grasses. The quality of the grazing may thus be greatly improved.

Mowing Roughage.—In the interests of grassland improvement it is desirable that rough foggage and tufts of withered grass and weeds should be mown over late in summer; this will enable young herbage to make satisfactory growth in early autumn for use during the remaining months of the year. It is sometimes considered that roughage is readily eaten down by grazing stock when keep is scarce in the autumn, but it is scarcely as good as young grass, in the interest of which its removal is to be recommended.

Early Mowing for Hay.—Many fields of neglected and unimproved grass laid up for hay are badly infested with yellow rattle, ox-eye daisy, Yorkshire fog, knapweed and other species that greatly reduce the value of the hay. It deserves to be borne in mind that numbers of these weeds are annuals, and that seeding may be prevented—and thus the extension of the weeds arrested—if the grass is cut for hay rather earlier than usual. Observation will indicate when the weeds are near the flowering stage, and this is the time to cut. Not only will weeds be reduced if this course is pursued for two or three years, but the hay will be of better quality, and so make up for some loss in weight.

Cutting Surplus Grass for Hay or Silage.—Where intensive manuring and rotational grazing are practised it may happen that the supply of grass gets ahead of the capacity of the stock to keep it down. In such an event it is very desirable that the grass shall not get coarse and afford an opportunity for weeds to mature; the grass should, therefore, be cut while still young, and be converted into hay or silage, which will be valuable fodder.

Consolidation.—On some light soils it may be necessary to consolidate the surface by heavy rolling; this will encourage wild white clover and add to the capacity of the soil to bring up water from below, while at the same time giving the herbage a firmer root-hold. Grass land that has been thoroughly harrowed will often be the better for rolling after wild white clover, lime and fertilizers have been distributed.

(*To be continued*)

SMALL HOLDINGS FOR UNEMPLOYED WORKERS: PROVISION OF COTTAGES

IN connexion with any scheme for the creation of small holdings by the State or by Local Authorities, the provision of cottages must play an important part. In order to carry out efficiently a scheme involving the erection of dwellings in rural areas, the building labour of the district must be utilized as far as possible. In these circumstances it is eminently desirable that the dwellings should be straightforward and simple to construct in order to combine the essentials of soundness and economy. It would also be a matter of regret if the dwellings were not attractive—or at least inoffensive—with some affinity to the character of traditional cottage design of their several districts.

To demonstrate the possibility of fulfilling these requirements two types of cottages, giving minimum (but not pinched) accommodation, that are suited respectively to south-east and north-west England, are here described and illustrated. The districts mentioned are broadly the divisions in which steep-pitched tile roofs and low-pitched slate ones are respectively traditional; from these controlling facts arise the characteristic internal forms usual to each area. In both cases the cottages might be built with normal materials, by local builders (after tendering in competition), at a cost of approximately £400 each, and such prices have actually been obtained.

The lowest tender for the two gabled detached cottages illustrated (Figs. 1 and 2), inclusive of drains, water supply and paths, was £820. These south-country cottages were built for workers on the field station of the Institute of Agricultural Parasitology at Winches Farm, between St. Albans and Hatfield. They are of brick with hand-made sand-faced tile roofs and weather-boarded gables; the rooms are of reasonable size and pleasant shape; and the inclusion of one bedroom on the ground floor enables this to be made use of as a sitting-room should fewer than three bedrooms be actually required. Economy results from the simple shape, beam and joist upper floor permitting light scantlings and ensuring adequate roof tie by the first floor cross joists, small amount of external walling, and compact water service and drainage provision. Each room has a fireplace. The ubiquitous but unlovely Fletton brick is used for the walling, and the complications and uncertainties of cavity walls are eschewed, external walls being 9 in. thick, well tarred externally up to

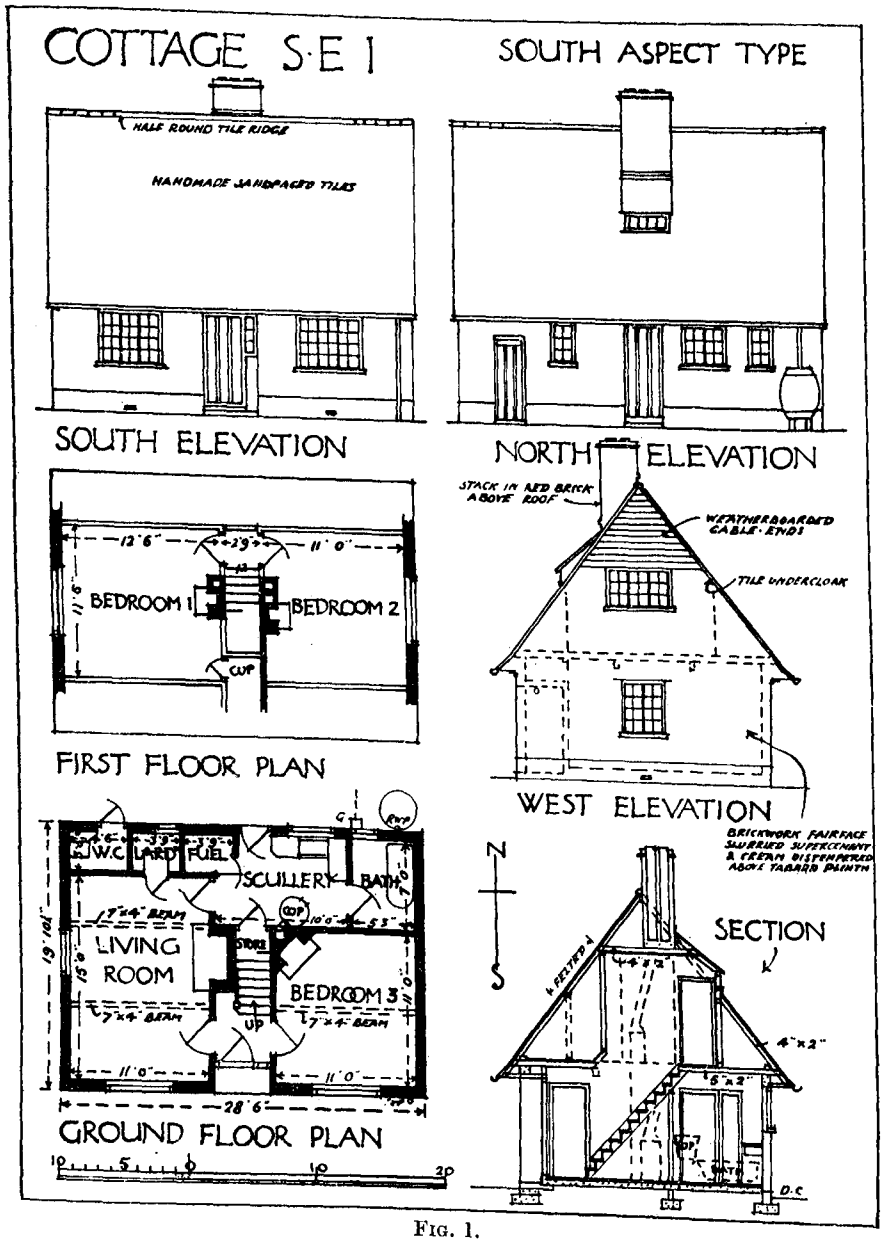

FIG. 1.

18 in. high, and slurried with super-cement distempered cream colour above. By this treatment the salmon-pink colour and harsh machine-made lines of the bricks are obscured, pointing is obviated, and a weatherproof face is given. Such cottages would not be out of place if erected anywhere east of a line joining the Wash and Southampton Water.

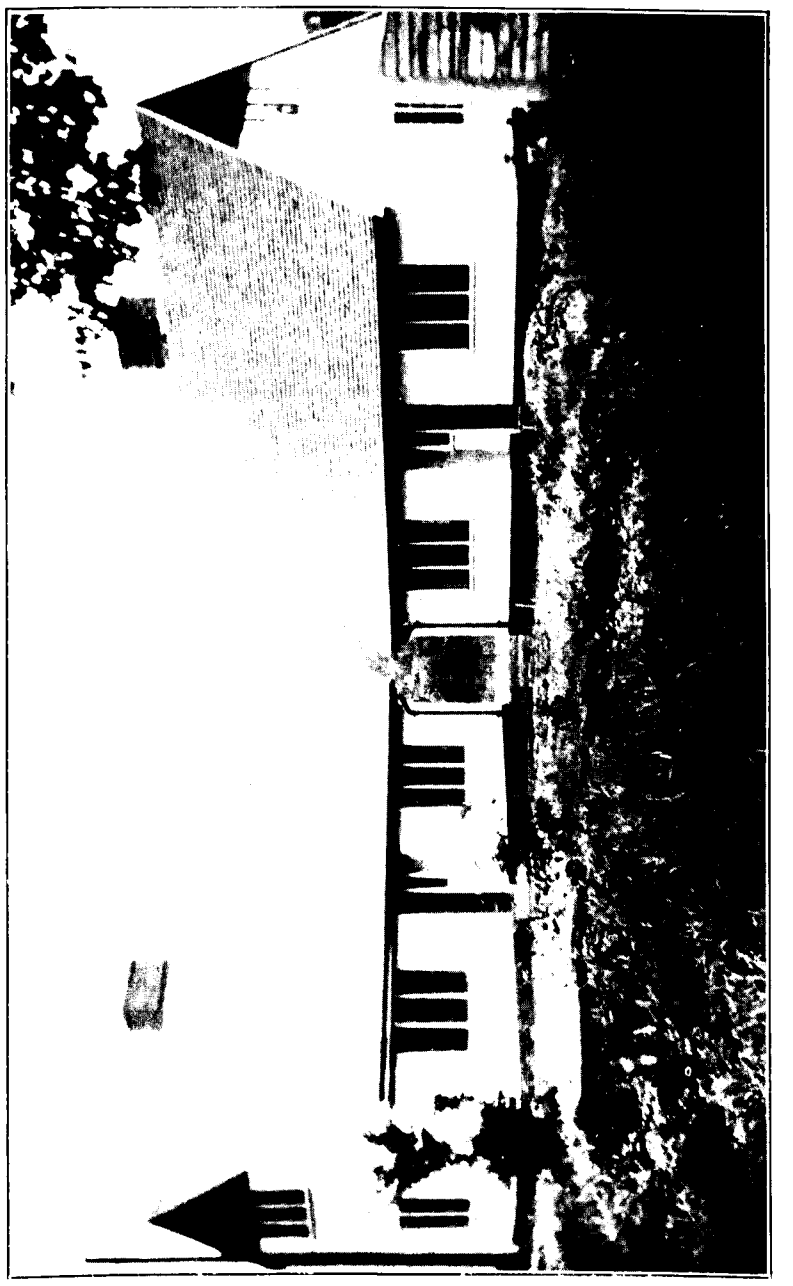

FIG. 2.—Gabled, detached cottages in Hertfordshire.

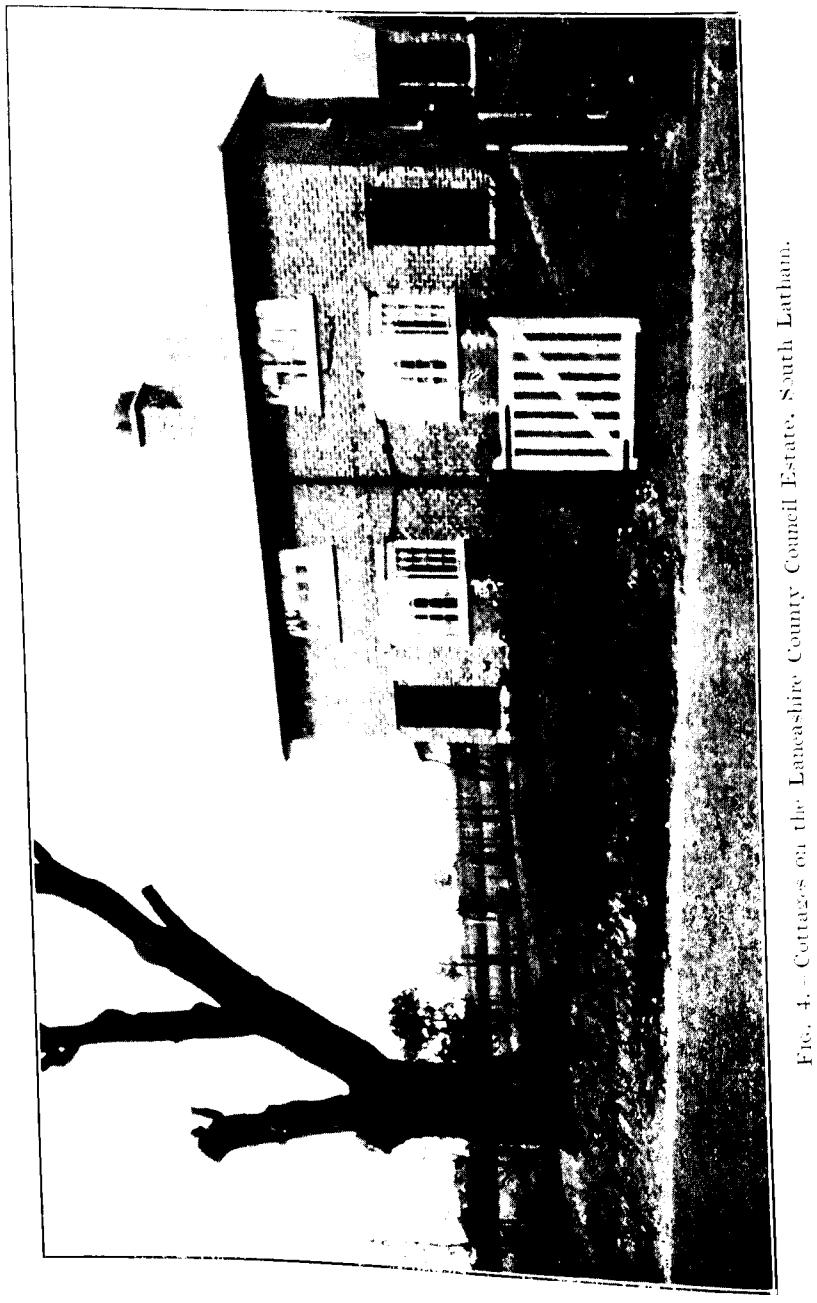

Fig. 4.—Cottages on the Lancashire County Council Estate, South Latham.

North and west of the above-mentioned line, cottages with flatter-pitched slated roofs are, speaking generally, more in accord with traditional character—usually a safe guide. Such cottages, to afford equivalent accommodation, need to be differently schemed, the three bedrooms being placed on the upper floor. In this form, when reduced to minimum limits and built singly, an unpleasant "pillbox" proportion is unavoidable; this may be overcome where it is possible to build in pairs, as in the example illustrated (Figs. 3 and 4) from the Lancashire County Council estate at South Latham. These excellent cottages, with a useful outbuilding comprising cart or packing shed and piggery, have been built in considerable numbers for £1,010 per double set, the cost of the actual single cottage, comprising the accommodation blacked in on the plans, being £445. This price includes a bay window and certain internal conveniences which would not be

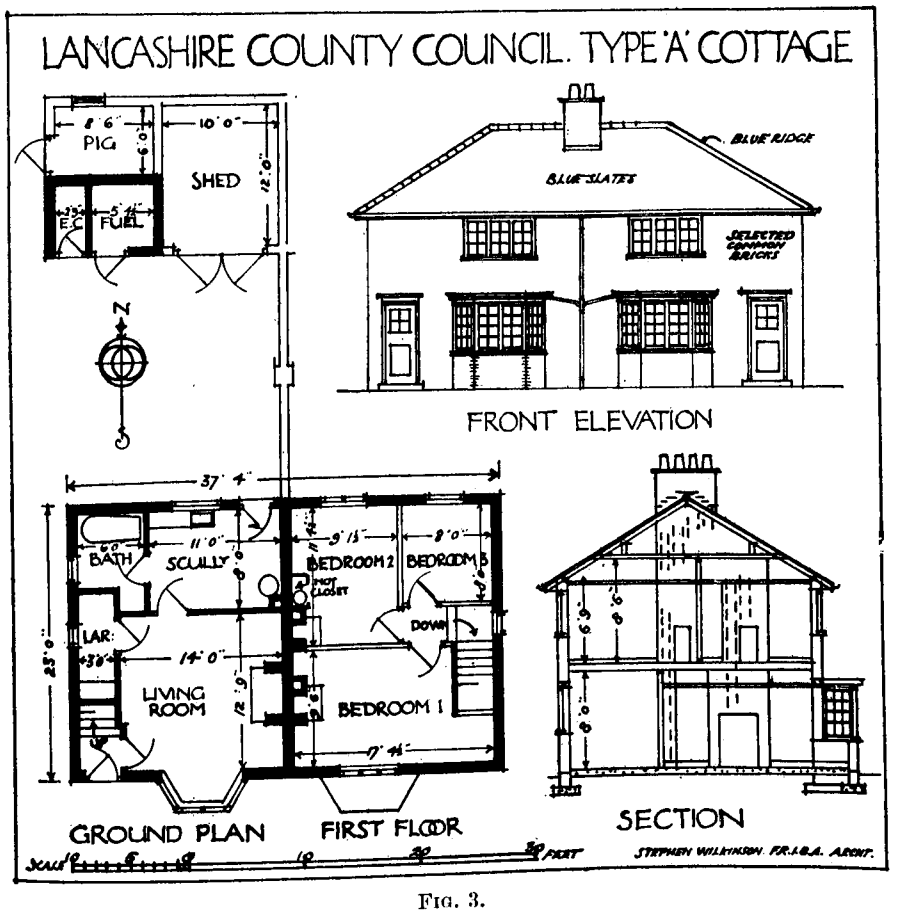

Fig. 3.

introduced where the maximum economy was necessary, the result being a cost that is practically identical with the southern type of cottage. This type might be built even in the beautiful west country—cream washed and with a roof of Cornish slate—without outraging local character.

* * * * * *

THE WORKING OF THE SEEDS ACT, 1920, IN THE SEASON 1929-30

NINE years have now elapsed since the Seeds Act came into operation to replace, in permanent form, the temporary provisions that were brought into force during the War. Primarily, its object was to afford some measure of protection to purchasers. In so far as this has been achieved, it has not been based upon stringent measures to suppress the sale of the cheaper classes of seed of lower quality, but upon the broader lines of affording the purchaser as much information as is possible and necessary to enable him to choose between offers of seeds of different qualities. At the same time it has become increasingly apparent, with the passing of the seasons, that seedsmen, too, have gained by the existence of the Act. By requiring a clear statement of certain material particulars on or before sale or delivery, and rendering the seller who gives false particulars liable to punishment, it makes hard the path of the disreputable adventurer into the seed business, and so affords protection to the trade itself.

Licensed Seed Testing Stations.—Under the Act, the Official Seed Testing Station for England and Wales was set up at Cambridge. The results obtained at the Official Station may be used by any seller as the basis of the declaration that he is required to give to the purchaser. In addition, the Minister is empowered to license private seed-testing stations, and there are at present some 82 of these, belonging to seed firms, which are licensed to test for the purpose of their own declarations. The number is one less than at the end of the previous season.

Seeds of all kinds may be tested, for the purpose of the statutory declaration, at 32 of these private stations. The others hold restricted licences, most of them permitting the testing of cereal seeds only. It is obvious, however, that the accuracy of the results obtained by all of them is a matter of fundamental importance, especially as the firms possessing their own stations include some of the leading seedsmen in the country, and form the "bottle-neck" through which distribution is largely effected.

The inspection of private, licensed seed-testing stations has remained in the hands of two Inspectors, who have visited each of the more important ones several times during the season. These stations are required to retain for a period a "Reserve Portion" of each sample of seed tested, and 1,310 of these Reserve Portions have been taken for check testing at the Official Station. As usual, attention has been drawn to any serious discrepancies disclosed by these tests. In addition, there have been issued to each station twice during the season a series of three "Referee" samples, taken from selected bulks, in order that a comparison might be made between the testing results obtained by licensed stations and by the Official Station on samples as nearly as possible identical. The general position, as shown by these two forms of control, was discussed at the Conference of Seed Analysts, held towards the close of the season, and mentioned subsequently in this report.

Visits to Seedsmen.—Most of the routine work in the administration of the Act takes the form of visits paid by Inspectors to the premises of seedsmen to ensure that they understand and carry out the obligations that are imposed upon them. During the year some 6,370 calls were made, including 1,120 to sellers who had not previously been visited. These figures differ but little from those for the preceding year. It has been mentioned in earlier reports that one of the difficulties encountered is that of the trader whose main business lies in some other direction, but who takes up seeds as a side-line, probably for a short period in the year. Most of these sellers handle only packeted seed, but constant efforts have nevertheless been made to bring them under surveillance. The greater part of the time given to inspectional work, however, is spent among seedsmen in the usually accepted sense of the term, and it is worth recording that there is a fairly general consensus of opinion on the part of the Inspectors whose duties include making these calls, that they are, as a rule, not unwelcome visitors.

Visits to Farmers.—In conjunction with the inspection of seedsmen's stocks, the officers engaged on seeds work have continued their efforts to bring home to those farmers who sell seed the fact that they, too, are required to comply with the provisions of the Act. Where other duties bring Inspectors into touch with farmer-sellers, the opportunity is taken to explain the position to them. Rather more than a thousand

visits, wholly or partially on business connected with the Act, were made to farmers during the season.

Control Sampling.—During the course of their visits, Inspectors take each season a number of "control samples" for the purpose of checking, by means of a test at the Official Seed Testing Station, the particulars declared by the seller. Excluding some non-scheduled seeds, which are the subject of a separate paragraph below, the actual number of control samples thus taken was 1,796, or about 70 more than last year. They included 369 samples of clover, 217 of grasses, 24 of field seeds, 93 of sugar beet, 355 of other roots, 232 of vegetable seeds, 95 of cereals and 411 of packeted seeds. Leaving packeted seeds out of account for the moment, it was necessary to draw the attention of the seller to omissions or discrepancies in 121 cases. There were 16 instances of failure to declare the country of origin of grass or clover seeds; 15 of omission to state the bushel weight of rye-grass; 35 of declarations either incomplete in some other respect or omitted altogether; and one case in which the seller based his statement on his own unauthorized test. The remaining 54 cases all disclosed discrepancies in either purity or germination, and included 7 samples of grass seed, 25 of clovers, 13 of roots and 9 of vegetables. Of these, 17 showed variations between the declared purity and that found in the check analysis, 5 of them of less than 3 per cent., but 9 of more than 5 per cent. The other 37 cases were of germination discrepancies, 18 of which were of less than 10 per cent. (and, therefore, not far outside the permissible limits of variation), 10 of more than 10 per cent. but less than 15 per cent. and 9 of more than 15 per cent. To sum up in a few words the position as regards non-packeted seeds, nearly 7 per cent. of the samples taken gave rise to correspondence with the seller—1 per cent. of them by reason of a difference as to the purity of the seed, 2 per cent. on account of the germination, and the remaining 4 per cent. because of some other matter, such as the omission of other statutory particulars.

Packeted Seeds.—The tendency for the trade in packeted seeds to become more and more concentrated in the hands of large and reputable firms still continues. It is common to find that retailers hold agencies for one or other of a small number of well-known houses and stock their packets on the "sale or return" system. The result is, of course, to reduce the practice of holding over a few remaining packets from season to season and so to lessen the possibility of seed of

low germinative power being sold to the small customer. The samples of scheduled seeds in packets taken during the season numbered 411. There were a few cases of discrepancies in purity and of incomplete declaration on the packet, but mis-statements as to germination occurred in only 3·5 per cent. of the total, showing a noticeable improvement even upon the figures for the previous season.

Non-Scheduled Garden Seeds.—From time to time the suggestion has been made that, for the protection of home gardeners and allotment-holders in particular, the salad seeds in common use should be brought within the scope of the Act. In order to obtain some precise information as to the quality of seeds of this kind offered to the public, small purchases were made over the counter in many parts of the country. The seeds purchased comprised 31 samples of lettuce, 24 of celery, 25 of leek, 21 of spinach and 27 each of radish and parsley.

A few poor samples, consisting no doubt of old seed, were found, but generally speaking the tests showed the seeds to be satisfactory.

Seed Analysts' Conference.—The Eighth Conference of Seed Analysts took place at the Official Seed Testing Station on July 25, 1930, with Sir A. D. Hall in the chair.

The Chief Officer of the Station reviewed in some detail the results of testing the two series of "Referee" samples that had been circulated to licensed stations during the season. These had consisted of white clover, cocksfoot and mixed rye-grasses, followed by carrot, sugar beet and tares. Although the results showed room for improvement in certain respects, the Chief Officer thought that, on the whole, the analysts at the stations were to be congratulated on the measure of uniformity attained. At a subsequent stage of the meeting, the Chief Officer referred to a number of points which had arisen during the season's work, including the identification of heated samples, weevils in seed peas, dodder in flax, the effect of dressings on the germination of sugar beet seed and the test period for carrot seed.

Professor S. P. Mercer, of the Northern Irish Official Seed Testing Station, read a paper on work that has been conducted on the identification of rye-grasses by means of ultra-violet light.

Training and Examination of Seed Analysts.—The ninth course of instruction in the principles and practice of seed testing was held at Cambridge during June and July. Eleven

analysts took the course and all sat for the examination. Only one candidate failed to satisfy the examiners. The standard of efficiency shown in the written papers was said by the examiners to have been higher than for several years past.

Seed Analysts' Bulletin.—Two issues of this Bulletin were prepared and circulated during the year. As usual, the full results obtained from the examination of "Referee" samples were tabulated and discussed; some particulars were given of seed control in Scotland, the Irish Free State and other parts of the world; attention was drawn to new import regulations imposed in certain of the Dominions and foreign countries, and articles were included dealing with the English wild white clover certification scheme, and with a number of other matters of interest to seed analysts.

Testing of Seeds for Export to the Dominions.—Towards the end of 1926, an arrangement was made whereby the cost of testing, at the Official Station, seeds for export to certain of the overseas Dominions should be met out of a grant from the Empire Marketing Board. There was, of course, no intention that this arrangement should be of a permanent character, but it was hoped that the financial assistance thus afforded would enable seedsmen at home to obtain a foothold in, at least, certain sections of the inter-Empire seed trade. It has been usual, in making grants of an experimental though commercial nature, to limit their operation to a period of three years, and a decision has now been reached that the grant in this case must cease at the end of July, 1931. The number of samples tested under the scheme during the seed year 1929-30 was 1,209, consisting mainly of vegetable and pulse seeds, but including also grasses and clovers, mangolds and beet, and a few samples of cereal seeds.

Seed Potatoes.—It was necessary to institute inquiries in 31 cases where the statutory requirements relating to the sale of seed potatoes seemed to have been infringed. Of these 19 related to apparent mis-statements as to variety and 8 to size and dressing, while in 4 instances the declaration was incomplete. Twenty of these cases were reported to the Department of Agriculture for Scotland, as relating to seed potatoes of Scottish origin, and prosecutions were instituted in three instances, a conviction being recorded in each one. The fines imposed were £5 in two cases and £3 in the other. In addition, the Scottish Department issued a warning to sellers in 11 instances. No English seller

of seed potatoes was prosecuted during the season, though warnings were given on three occasions.

The enforcement of the law in respect of seed potatoes is rendered difficult by reason of the fact that a great many greengrocers and other traders undertake the sale of seed potatoes during a short period of the year. Every reasonable effort is made to bring these casual sellers into line with regular seedsmen, and a single-sheet instruction has been prepared to help them to understand just what is required of them by the Act.

Prosecutions.—Only two prosecutions were taken under the Act during the season. In one case a firm at Montgomery was proceeded against and fined £2 for failing to give the necessary particulars on the sale of swede seed; and in the other a merchant at Uppingham was prosecuted and fined £1 for making a false statement as to the percentage germination of swede seed.

General.—Copies of the Seeds Act, 1920 (price 3d. net); the Seeds (Amendment) Act, 1925 (1d. net); and the Seeds Regulations, 1922 (3d. net), may be obtained, either directly or through any bookseller, from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2. A leaflet explaining the purpose and effect of the Act, and giving information as to how to obtain tests of seeds, may be obtained, free of charge, from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

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OYSTER SHELL AND COCKLE SHELL FOR POULTRY

J. AUGUSTUS VOELCKER, C.I.E., M.A., B.Sc., Ph.D.,
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AT various times, I have had submitted, for analysis, samples of oyster shell and of cockle, scallop and similar shell, and have been asked what is the difference between them, and what there is to account for the fact that, while the former is in high favour among poultry keepers and is considered indispensable, the latter obtain neither favour nor sale. Analyses failed to discover anything in the one or the other which, on chemical grounds, would account for the difference. As they were found to be practically equally rich in the constituent, carbonate of lime, for which they are mainly used, viz., to ensure the production of a firm shell, one wondered how far the preference for oyster shell was based purely on "fancy" and on judicious exploitation of its virtues, and how far on actual fact.

Possibly, there might be some difference between the two, in respect of the mechanical condition and state of aggregation, which might occasion what chemical analysis did not reveal. Anyhow, it seemed well to put the question to the practical test, and, for that purpose, I enlisted the help of a friend, himself well known as an authority on poultry matters, and accustomed, by long experience, to the carrying out of reliable investigations.

At the outset, it was found that, whereas there is a ready demand and good sale for oyster shell at from £5 to £5 7s. 6d. a ton, and that it is brought over to this country from America, cockle, scallop and similar shell lies accumulated at many places on our shores and finds a use practically only as material for making garden paths, but not for feeding poultry.

In the course of inquiries made, it was ascertained that, for example, on the Essex coast, at the present time, cockle shell, as it lies in the heap, can be obtained at 3s. per ton, or 8s. a ton put on rail, as against the £5 or more per ton realised from the sale of imported oyster shell. It is true that, when it does find its way to sellers of poultry food, it is occasionally met with as an adulterant of oyster shell, and, if asked for by itself, will be charged at from £4 to £4 5s. a ton. In one case (Essex), whence the two materials were sent for comparison, the relative prices quoted were: oyster shell, 7s. per cwt. delivered; cockle shell, 4s. per cwt. delivered. In another instance (Devonshire) the quotations were: oyster shell, 6s. per cwt., cockle shell, 4s. 9d. per cwt. Speaking generally, it may be said that there is a difference of from £2 to £2 10s. a ton in price between the two.

There remains the fact that cockle and similar shell is not in favour with poultry-keepers, the majority of whom will have nothing whatever to do with it, but declare that poultry will reject it while they will eat oyster shell greedily. Encouragement to this belief in the vast superiority of oyster shell is naturally given by the importers, and circulars relating to it warn purchasers against buying shell that attracts rats, contains salt that rots the bags, and that has fibre, dirt and other impurities with it. Other virtues of oyster shell are claimed, and, in particular, the fact of its being of a firm, flaky character and not lumpy or crumbly, as well as its being kiln-dried and free from excess water. It was to test the value of these assertions that the experiments here recorded were undertaken.

The first step was to analyse samples of each kind of shell, and the results obtained are shown in Table I.

TABLE I

	Oyster Shell per cent.	*Cockle shell* per cent.
Carbonate of lime	96·91	96·40
Siliceous matter	·14	·49
Moisture, &c.	2·95	3·11
	100·00	100·00

There was nothing in these figures to suggest any ground for the superiority of oyster shell. Both were, to all intents, carbonate of lime, and practically equally rich in this constituent, one that is recognised as necessary for successful egg-laying. Unless there were some virtue in the particular state of aggregation of the carbonate of lime in the case of the oyster shell, or some difference in the mechanical condition of the respective materials, it was difficult to see why there should be any difference in their use, or reason for the preference generally given to the dearer material.

First Experiment.—The experiment was carried out, in the first instance, for a period of nine weeks, February 13 to April 17, 1930. Fifty-five Wyandotte hens were placed in a pen, and these, as any of them became "broody," were replaced by other hens.

At the outset, the hens were fed for the first week with oyster shell only added to their usual food, which included 4 lb. of flint grit to the pen per week. Four pounds of oyster shell were used to the pen for the week, at the end of which

time the quantity consumed by the birds and that left unused were noted. The following week the oyster shell was partly replaced by cockle shell, the quantities consumed and left being noted, as before. Each week the amount of oyster shell was further reduced and that of cockle shell increased, until, in the ninth week, cockle shell had been entirely substituted for oyster shell.

Table II gives the amounts of each kind of shell given per week to the 55 birds, and the amounts of each consumed or left to be picked up :—

TABLE II.

Week	*Shell given*			*Shell consumed*		*Shell unconsumed taken away*	
	Oyster	Cockle	Total	Oyster	Cockle	Oyster	Cockle
1930	lb.	lb.	lb.	lb.	lb.	lb.	lb.
(1) Feb. 13–20	4	0	4	2	—	2	—
(2) ,, 20–27	3½	½	4	mixed 2½ lb.		mixed 1½ lb.	
(3) ,, 28-Mar. 6	3	1	4	2¾ ,,		1¼ ,,	
(4) Mar. 6–13	2½	1½	4	3 ,,		1 ,,	
(5) ,, 13–20	2	2	4	3 ,,		1 ,,	
(6) ,, 20–27	1½	2½	4	3 ,,		1 ,,	
(7) ,, 27-Apr. 3	1	3	4	3 ,,		1 ,,	
(8) Apr. 3–10	½	3½	4	2¾* ,,		1¼ ,,	
(9) ,, 10–17	0	4	4	2¾* ,,		1¼ ,,	

* The hens were not laying so well at these periods, which may account for the rather lower amount of shell consumed.

The birds did quite well throughout the period, and in no case was there any complaint of "soft shell" with the eggs. When, after the first week, the change from oyster shell to a mixture with cockle shell was made, the birds were noticed to pick out the brighter and more shiny particles of oyster shell, but, this done, they went on to the rest quite satisfactorily, and, in the end, as the above table shows, consumed the cockle shell just as well as they had done the oyster shell alone. There is no reason, accordingly, for considering that the oyster shell is superior, or that the difference in price between the two materials is justified.

Second Experiment.—At the conclusion of the above trial a further experiment was made. Two separate pens of birds were taken, the one—as additional food—receiving oyster shell only, and the other pen cockle shell only, and, as before, noting the amounts of each kind of shell consumed.

Again, about 59 Wyandotte hens were placed in each of two pens, and to the one pen oyster shell only was given as an addition, and cockle shell only to the other—the relative

amounts consumed and left to be picked up being noted. Four pounds of grit per week was, as before, given to each pen.

This experiment was carried on for five weeks, and the returns obtained are given in Table III.

TABLE III

Week	*Total put down each week*		*Shell consumed*		*Shell unconsumed taken away*	
	Oyster	Cockle	Oyster	Cockle	Oyster	Cockle
1930	lb.	lb.	lb.	lb.	lb.	lb.
(1) Apr. 17–24	4	4	2¾	2¾	1¼	1¼
(2) ,, 24–May 1	4	4	2¾	3	1¼	1
(3) May 1– 8	4	4	3	3½	1	½
(4) ,, 8–15	4	4	3	3	1	1
(5) ,, 15–22	4	4	2¾	2¾	1¼	1¼
Total	20	20	14¼	15	5¾	5

From these results, it will be seen that the lot receiving cockle shell only took just as much as did the lot on oyster shell. Moreover, there was no apparent difference in the health or well-being of the two sets, and no complaint about the eggs and their shells.

Conclusion.—It is clear from these trials that, when birds have become accustomed to the use of cockle shell, they will take it just as well and freely as they will oyster shell, and that, as the relative analyses would indicate, there is no practical difference between the two as a source of lime, either as regards the health of the birds or the nature of the eggs. Hence, the preference generally accorded to oyster shell must be put down merely to "fancy," and to advocacy of the more costly material. The conclusion to be drawn, therefore, is that the cheaper material—cockle shell—will answer the purpose quite as well as oyster shell.

* * * * * *

MARKETING NOTES

National Mark Eggs.—During the 11 months, January–November, 1930, the output of the authorized packing stations amounted to 205 million eggs, of which 147 million were packed under National Mark labels. During the four months, August–November, the total output of the packing stations was greater by 20 per cent. and the National Mark output by 35 per cent. than during the corresponding four months of last year.

Keen interest continues to be shown in the scheme, and of late more inquiries have been received from all parts of the country. Some of these seem likely to lead to the organization of packing centres in localities that are not at present served by the scheme.

A report has recently been received on two auctions held in the same town in the south of England, at one of which eggs were being sold by a National Mark egg packing station, while, at the other, ungraded supplies were on offer. The appearance of the National Mark packs and the ease and speed with which they were disposed of were very striking by comparison, and an object lesson to both producers and buyers of the value of standardization in marketing. Good prices were made for the National Mark eggs, whilst comparatively poor prices were received for the ungraded supplies.

Under the conditions attaching to the scheme, every National Mark label applied to a package of eggs (other than a carton holding 1 doz. or ½ doz. eggs) must bear a code mark indicating the date of packing. It is required that the code mark shall be over-stamped in black in the left-hand bottom space of the label, below the grade designation, and the letters must be ⅜ in. in height. A check slip in the form authorized by the Ministry must also be placed inside each container so labelled, bearing both the date of packing and the code mark corresponding to that appearing on the outside of the case. This arrangement will continue during 1931, and a code-dating calendar for that year has been prepared. Copies of the calendar may be obtained on application to the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

National Mark Dressed Poultry.—Although this scheme is still in the experimental stage, about 16,000 head of dressed poultry were marketed under National Mark labels during the first six months from its inception on June 2, 1930. Slightly increasing supplies are now coming forward.

Inquiries from producers and packers continue to be received, and further applications for authorization to apply the National Mark are anticipated in the near future.

National Mark Beef.—The weekly average number of sides (including quarters and pieces expressed in terms of sides) of beef graded and marked with the National Mark during December, 1929, and November, 1930, and the number of sides graded and marked for the four weeks ended December 13, 1930, were as follows :—

	Number of sides
LONDON	
Weekly average—Dec., 1929	1,198
,, ,, —Nov., 1930	2,026
Week ended — ,, 29, 1930	2,126
,, ,, —Dec., 6, 1930	2,221
,, ,, — ,, 13, 1930	2,353
BIRKENHEAD*	
Weekly average—Dec., 1929	254
,, ,, —Nov., 1930	996
Week ended — ,, 29, 1930	634
,, ,, —Dec., 6, 1930	744
,, ,, — ,, 13, 1930	986
SCOTLAND*	
Weekly average—Dec., 1929	1,371
,, ,, —Nov., 1930	1,999
Week ended — ,, 29, 1930	1,904
,, ,, —Dec., 6, 1930	2,352
,, ,, — ,, 13, 1930	2,420
TOTAL LONDON SUPPLIES (All sources)	
Weekly average—Dec., 1929	2,823
,, ,, —Nov., 1930	5,021
Week ended — ,, 29, 1930	4,664
,, ,, —Dec. 6, 1930	5,317
,, ,, — ,, 13, 1930	5,759
BIRMINGHAM	
Weekly average—Dec., 1929	442
,, ,, —Nov. 1930	464
Week ended — ,, 29, 1930	469
,, ,, —Dec. 6, 1930	546
,, ,, — ,, 13, 1930	486

* Sides consigned to London.

The total number of sides of beef graded and marked during November, 1930, was the highest for any month since the introduction of the scheme, both for London and for Birmingham, and forms striking evidence of the hold that the National Mark Beef Scheme has now obtained in the trade in both these areas.

The continuation of the National Mark Beef Scheme in the London and Birmingham areas until October 31, 1931, has been authorized, also the extension of the scheme to the Leeds and Bradford areas, and to towns in South Wales, for a period of twelve months. This was recommended by the Inter-Depart-

mental Committee on the Grading and Marking of Beef, whose Report* should prove of considerable interest to producers and distributors. It is hoped to introduce the National Mark Beef Scheme in the Leeds–Bradford area towards the end of January, 1931.

National Mark Apples and Pears.—The total number of authorized packers in the Apple and Pear Scheme is now 93 for apples and 18 for pears.

The following is a list of growers who have recently been authorized :—

APPLES

Cambs : Ayers & Son, Elm, Wisbech.
B. N. Doubleday, Upwell, Wisbech.
Hickman & Co. (Wisbech), Ltd., Leverington, Wisbech.
Hopkins & Morton, Kentmere, March.
Cheshire : H. C. Groom & Co., Bellevue Farm, Guilden Sutton, Chester.
Devon : S. B. Neill, Sunnyhaye Fruit Farm, Woodbury Salterton, Exeter.
Essex : T. B. Douglas, Stratton, Hatfield Peverel, Chelmsford.
W. Lawrence, Fruit Farm, Ashdon, Saffron Walden.
H. C. Stone, Thanet Grange, Prince Avenue, Southend-on-Sea.
M. Swan, The B.X. Ranch, Little Totham, Maldon.
W. L. Taylor, Galleywood, Chelmsford.
Hunts : E. H. Harrison, The Shrubbery, St. Neots.
Kent : S. E. Foreman, Summer Lees, Hernhill, Faversham.
Major J. H. Gill, D.S.O., Foxglove, Willesborough, Ashford.
Notts : T. R. Jeffcock, Welham Cottage, near Retford.
Salop : E. Nicholls, Weeping Cross, Cross Houses.
Somerset : Norton-sub-Hamdon Fruit Farm, Norton-sub-Hamdon.
Smith and Underwood, Street.
Suffolk : Miss M. B. Amos, The Fruit Farm, Beyton, Bury St. Edmunds.
Surrey : Lieut.-Col. S. R. Normand, Manor Lodge, Stoughton, Guildford.
Worcs : J. A. Southall, Offenham, Evesham.
W. F. Swift, Fladbury, Pershore.

PEARS

Cambs : Ayers & Son, Elm, Wisbech
Hopkins & Morton, Kentmere, March.
Cheshire : H. C. Groom & Co., Bellevue Farm, Guilden Sutton, Chester.
Essex : T. B. Douglas, Stratton, Hatfield Peverel, Chelmsford.
Kent : East Malling Research Station, East Malling.
Norfolk : Colonel B. J. Petre, Westwick Fruit Farms, Westwick, Norwich.
Worcs : D. Blore, Craycombe Farm, Fladbury, Pershore.

Authorized packers are required to indicate the date of packing on packages containing National Mark apples and pears. For this purpose, packers, if they so desire, may substitute a code date on the National Mark label for the actual date. The code date, when used, must be over-stamped in black upon the National Mark label in the place provided, the letters being $\frac{3}{8}$ in. in height.

* Cmd. 3648.

This arrangement will continue during 1931 ; code-dating calendars may be obtained on application to the Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

National Mark Tomatoes and Cucumbers : A Review of Progress.—The National Mark Scheme was applied to tomatoes and cucumbers in 1929, largely at the request of growers' representatives. The grade standards prescribed, and the regulations laid down as to packages and packing, follow closely those established by the British Glasshouse Produce Marketing Association.

Authorization of Packers.—In the first season, 78 growers were authorized for packing tomatoes and 24 for cucumbers. For a variety of reasons, the development of this scheme has not been so notable as in the case, for example, of the apple and pear scheme. In the first place, there are a number of growers with a very large output who have established private marks and a reputation for consistent grading ; some of these growers have remained outside the scheme, and, by their example, they have influenced smaller growers to do the same. Others have failed to appreciate the necessity for strict compliance with the grade standard, or have desired a standard that would vary with the fluctuating condition of the crops. Some have been deterred by the cost of labels and the cost of pasting labels on the boxes. Despite these factors, however, a further 11 tomato growers and 7 cucumber growers were authorized during 1930, making, in all, 89 authorized packers of tomatoes and 31 of cucumbers.

Quantities Marketed.—It is impracticable to obtain precise figures as to quantities of tomatoes and cucumbers marketed under the Mark, but the tomato scheme, at any rate, has made substantial progress, and there is no doubt that large quantities of National Mark tomatoes have reached the markets.

The quantity of National Mark cucumbers marketed has been relatively small, even with packers who have given the scheme full support. There are several reasons for this. With early crops, the proportion of cucumbers that fall within the National Mark grades is small, prices are high and buyers are not critical as to shape. Growers therefore find it more remunerative to pack below National Mark grade. Again, in the last two seasons, a large proportion of cucumbers have lacked the bright-green colour required by the scheme, and authorized packers have not been able to apply the Mark to that part of their output. They naturally feel that the withholding of the Mark gives buyers an impression that the un-

marked packs are much more inferior in quality than is actually the case. The edible quality of a cucumber bears little or no relation to its colour, but colour, nevertheless, is an important factor in selling; the average consumer prefers a bright-green cucumber. Objection is taken also to the exaggerated impression of inferiority given to unmarked packs that are just below National Mark grade in straightness and shape. No satisfactory suggestion for dealing with these matters has yet been made.

Distribution.—Most National Mark tomatoes from the Lea Valley area have been placed in the Midland and Northern markets, a relatively small proportion only coming on the London markets. Those from the Worthing district have been divided between the London markets and the south-coast towns. Provincial growers generally have placed their supplies in neighbouring towns. A very small proportion of purely local trade has been developed, but as the scheme does not at present offer immediate advantages where the producer sells directly to the retailer, development in this direction is uncertain.

Grading.—Inspection of supplies on packers' premises and in wholesale markets has shown that the grading of National Mark supplies, on the whole, has been satisfactory. Contraventions by six of the packers of tomatoes have been reported this year, and all but two of these were obviously due to lack of supervision of the packing operations. The improvement in the grading of tomatoes marketed by growers not using the Mark is most noticeable; several have stated that they are grading to National Mark standards, but do not apply to become authorized packers because they fear the effect of an adverse report should a few off-grade packages slip through under the Mark. There has been a definite and general improvement in the grading of cucumbers.

Packages.—Although a number of types of packages are authorized, the scheme has been practically confined to the non-returnable 12-lb. tomato box and the two-layer cucumber box. There is a definite reluctance to use the National Mark on tomato strikes and cucumber flats.

Labels.—The cost of National Mark labels seems to have had a deterrent effect upon some packers. The costing of labels is, therefore, being reviewed. Suggestions have been made (i) for incorporating a small National Mark with the grower's own label, (ii) the use of a small, gummed label to place on the grower's own label, and (iii) for a National Mark rubber stamp. To meet the views of many packers, the space

for the grower's name or mark has been enlarged, but it must be pointed out that if the full benefits of the National Mark Scheme are to be obtained and a basis for national advertising established, the National Mark on the label must be paramount and National Mark labels must be uniform for all packers.

The cost of pasting labels on boxes is also a source of complaint. Where ready-branded boxes have been used previously, it is an added cost that is irksome. In the marketing of almost all commodities, however, the use of printed or branded wood is being abandoned in favour of attractive coloured labels, and it would be a retrograde step to adopt branding because of the slight extra cost of the label and pasting. A bright and attractive label is undoubtedly an important factor in selling.

National Mark Strawberries.—Applications for enrolment in the National Mark Scheme for strawberries are still being received, and an important increase in the number of authorized packers may be anticipated next season.

The use of a new container (Deep No. 2 Climax chip basket) has been approved for packing strawberries under the Mark. This basket is capable of holding 2 lb. of fruit with greater ease, and with less risk of the berries being crushed, than the ordinary Climax chip.

National Mark Canned Fruit, Peas and Beans.—Displays of National Mark canned fruit continue to be a feature in grocers' shops, large and small, throughout the country. The popularity of the produce has been striking, and supplies are rapidly becoming depleted. Some authorized canners with large outputs report that they are completely sold out of certain varieties, and the anxiety of wholesalers to secure adequate supplies is shown by reports that contracts have been made to take the whole output of authorized canners for several years ahead.

Proposals to include additional varieties of fruit and vegetables in the scheme during 1931 are now under consideration.

National Mark Wheat Flour.—The following firms have been enrolled as authorized re-packers of National Mark flour:—

Alderton, Ltd., 2 Malton Street, Plumstead, S.E. 18.
Baldwin Flour Co., Blackburn, Lancs.
Hathway & Hillier, Lyneham, Wilts.
E. Patchell, High Street, Aylesford, Kent.
A. H. Rayward & Sons, High Street, East Grinstead, Sussex.

The cookery competitions that it is proposed to hold under the auspices of the National Federation of Women's In-

stitutes should do much to stimulate interest in National Mark flour in rural areas. Already numerous inquiries have been received for the names of wholesale and retail suppliers, and it is hoped that many more names of grocers and bakers will soon be added to the list of authorized re-packers. Any re-packer who packs and sells a minimum quantity of 10 cwt. of flour of all kinds per week, or who can produce evidence that during a period of six months before application he has purchased not less than one sack (280 lb.) of National Mark flour for re-sale, is eligible to apply for authorization in the scheme.

The Director of the National Bakery School, reporting on the bread-making tests carried out on behalf of the Ministry with representative samples of National Mark (Yeoman) flour from wheats of the 1930 crops, states that all the flours were of a good average standard and more uniform than in previous years. Good "oven-bottom," crusty bread (other than cottage) of excellent appearance, texture, flavour and keeping quality was baked by a simple process that has now been described in leaflet form (Marketing Leaflet No. 12E) for the guidance of bakers and others interested. Copies may be had on application to the Ministry.

National Mark Malt Products.—The demand for pharmaceutical malt extract with cod-liver oil is, to a large extent, governed by temperature and climatic conditions. The winter of 1929-30 was exceptionally mild, with the result that the sales of "malt and oil" of all kinds were considerably below normal; similar conditions obtained in the autumn of 1930. One important effect of the scheme has, however, been to encourage the use of home-grown malting barley to a far greater extent than would appear from a consideration of the quantities of malt products actually marketed under the National Mark. Some of the largest manufacturers have decided to use home-grown barley only for all their products, whether or not bearing the National Mark, and the tendency in this direction will no doubt become more pronounced as the advantages of the scheme, with its insistence upon standard quality, become more widely known.

National Mark Cider.—The Minister has appointed a National Mark Cider Trade Committee to consider applications for permission to apply the National Mark to cider made from home-grown fruit, to make recommendations thereon to the National Mark Committee, to consider reports regarding the application of the National Mark by cider makers and bottlers,

and generally to advise the National Mark Committee and the Ministry in regard to the application of the Mark to cider made from home-grown fruit.

The National Mark Cider Trade Committee consists of :—

G. Stubbs, Esq., C.B.E., F.I.C., F.C.S. (Chairman).
Professor B. T. P. Barker, M.A., F.R.H.S.
The Hon. J. W. Best.
E. F. Bulmer, Esq.
R. H. Densham, Esq.
W. C. Gaymer, Esq.
A. Hole, Esq.
Sir Wm. Lobjoit, O.B.E., J.P.
J. H. Todd, Esq.
B. K. Welch, Esq.
S. Weston, Esq.
Mr. J. H. Gorvin, C.B.E., of the Ministry, is Secretary of the Trade Committee.

The Trade Committee, at its first meeting on December 4, decided to recommend the following manufacturers and farm makers for authorization under the Scheme :—

FIRST LIST OF APPLICANTS FOR AUTHORIZATION

London : H. & G. Simonds, Ltd., Plough Brewery, Wandsworth Road, London.

Berkshire : H. &. G. Simonds, Ltd., The Brewery, Reading.

Devon : Carr & Quick, Ltd., 16 Queen Street, Exeter (and at Topsham and Crediton).
Dartington Hall, Ltd., Skinners Bridge, Dartington, Totnes.
Edwin Hill & Son, Ltd., Staverton, Totnes.
H. &. G. Simonds, Ltd., The Tamar Brewery, Devonport (and at Crabbs Park, Paignton (N. P. Hunt & Son)).
Schweppes, Ltd., Hele.

Dorset : Dorset Farm Cider Makers' Federation.

Gloucester : Severn Vale Cider Co., Ltd., Bushley, Tenterbury.
Schweppes, Ltd., Bledisloe Cider Mills, Blakeney.
Sydney Willetts, Blakeney.

Hereford : Bonner & Durrant, Holmer.
William Evans & Co. (Hereford and Devon), Ltd., Widemarsh, Hereford.
R. E. Ridler, Clehonger Manor, Clehonger.
Watkins' Pomona Cider Co., Wye Bridge, Hereford.
H. Weston & Sons, The Bounds, Much Marcle, near Gloucester.

Middlesex : H. &. G. Simonds, Ltd. (trading as Ashley's Staines Brewery, Ltd.), Staines.
The Taunton Cider Co., Ltd., 20-24 The Arches, South Harrow.

Somerset : R. N. Coate & Co., Ltd., Nailsea.
The Quantock Vale Cider Co., Ltd., North Petherton, Bridgwater.
Schweppes, Ltd., Weare.
Somerset Cider Apple Growers' and Farm Cider Makers' Federation, Tor Court, Glastonbury.
The Taunton Cider Co., Ltd., Norton Fitzwarren.
E. H. Wells (trading as "Lorna Doone Cider Vintage"), Ford Fruit Farm, Wellington.

and was open to retail butchers who had regularly stocked National Mark beef for at least four weeks immediately before the competition. While the total entry (46) was not large, the competition proved a distinct success. The judges stated that the general standard of the exhibits was exceptionally high and rendered the judging difficult. They were impressed by the particularly attractive appearance and general high quality of the beef displayed, and considered that the competition as a method of encouraging consumers to appreciate high class, home-killed beef had certainly served its purpose.

The scale of points on which judging was based was as follows :—

General display and quality of National Mark Beef	40 points
Technical skill in cutting and the attractive presentation of joints	30 ,,
Display of appropriate posters and other advertising matter	30 ,,

Prizes of £20, £10 and £5 were awarded for the three best entries in each of the four groups, together with a number of prizes of £1 each. Photographs of the displays which received the first prizes are reproduced in the accompanying illustration inset. The three winners in each group and date of the group competitions were as follows :—

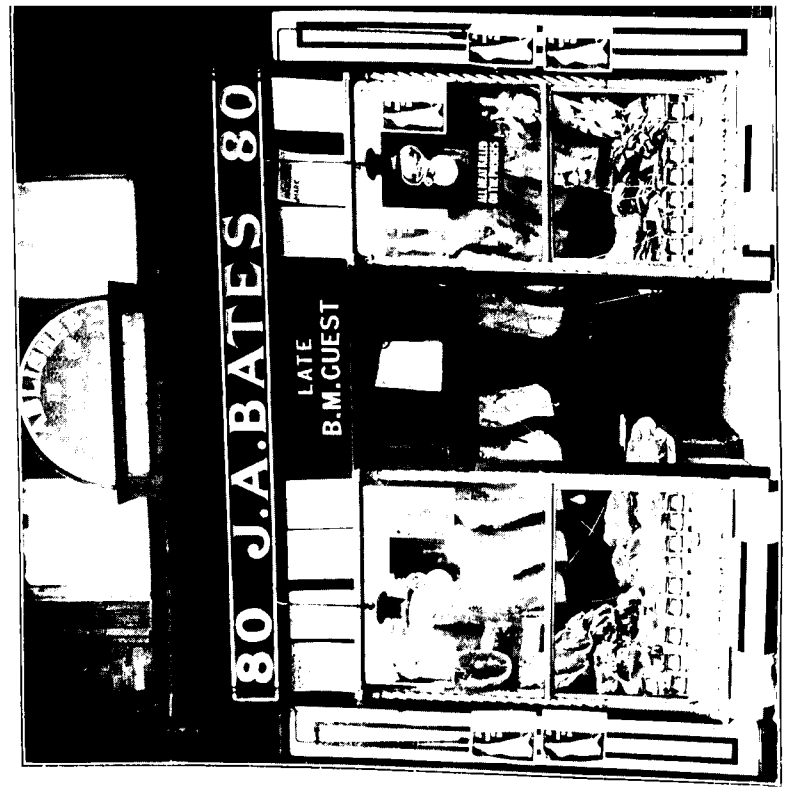
Group 1.—(North-Western Area) : November 26.
Judge : Councillor R. E. Probert, of Wolverhampton.
1st : G. A. Smith & Sons, 224 Soho Road, Handsworth.
2nd : E. T. Barker, 464 Bearwood Road, Smethwick.
3rd : Walter Smith, 524 Bearwood Road, Smethwick.

Group 2.—(South-Eastern Area) : December 3.
Judge : Alfred Pugh, Esq., of Pontycymmer, Glamorgan.
1st : F. W. Wright, 532 Moseley Road, Moseley.
2nd : Birmingham Co-operative Society, 1,102 Warwick Road, Acocks Green.
3rd : Birmingham Co-operative Society, 408 Coventry Road, Acocks Green.

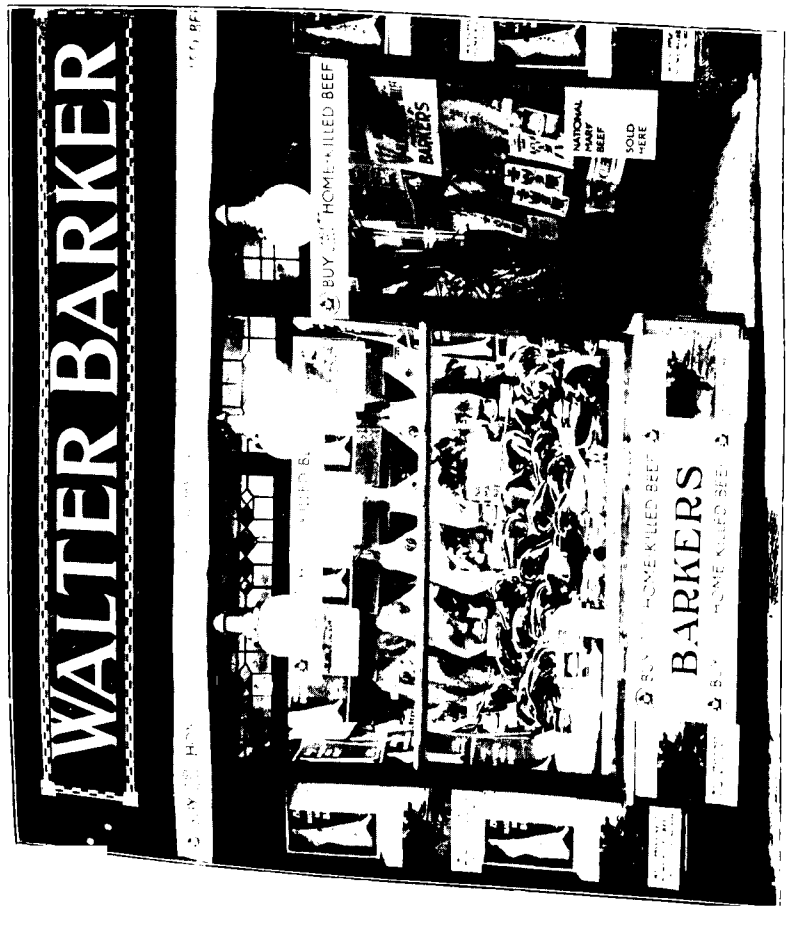
Group 3.—(North-Eastern Area) : December 10.
Judge : J. B. Pitchford, Esq., of Newport (Mon.).
1st : Walter Barker, 98 Alum Rock Road, Saltley.
2nd : J. Rowberry, 23 Gravelly Hill, Erdington.
3rd : Birmingham Co-operative Society, 551 Green Lane, Small Heath.

Group 4.—(South-Western Area) : December 17.
Judge : G. H. Collinge, Esq., of Southport.
1st : J. A. Bates, 80 Bristol Street, Birmingham.
2nd : W. H. Haynes, 1 Oak Tree Lane, Selly Oak.
3rd : Ten Acres & Stirchley Co-operative Society, 1369 Pershore Road, Stirchley, and 725 Bristol Road, Northfield.

A circular letter was dispatched during December to every butcher selling National Mark beef in the London and Birmingham areas, asking them to make a special feature of



Group 4. Mr. J. A. Bates, Bristol Street, Birmingham.



Group 3. Mr. Walter Barker, Saltley.

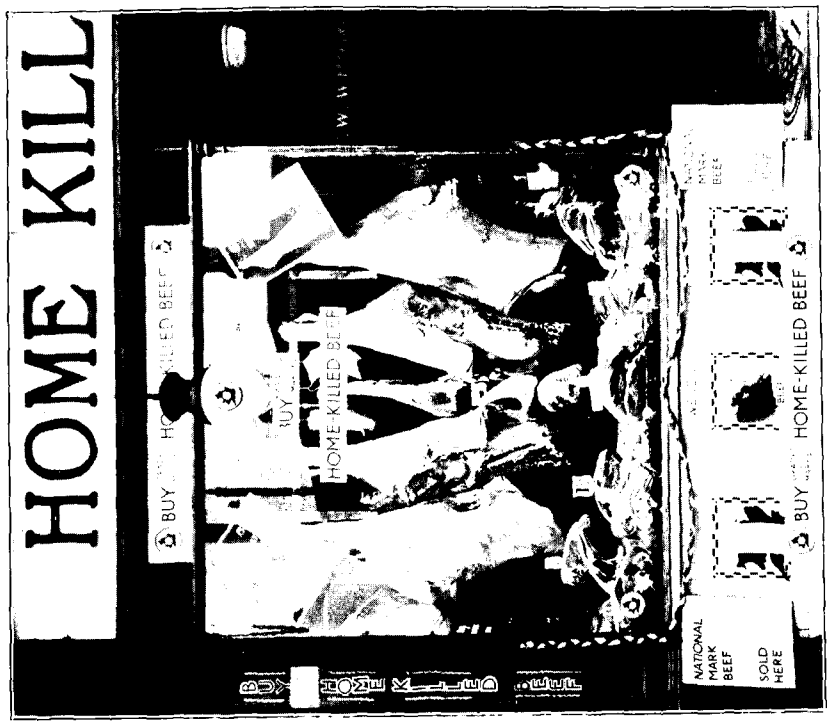
NATIONAL MARK BEEF: FIRST PRIZE WINDOW DISPLAYS AT BIRMINGHAM.

The Committee also recommended that authorized makers should be permitted to apply the National Mark to stocks of cider made from previous seasons' apple crops, provided that satisfactory evidence be forthcoming to show that such cider is qualified for sale under the National Mark.

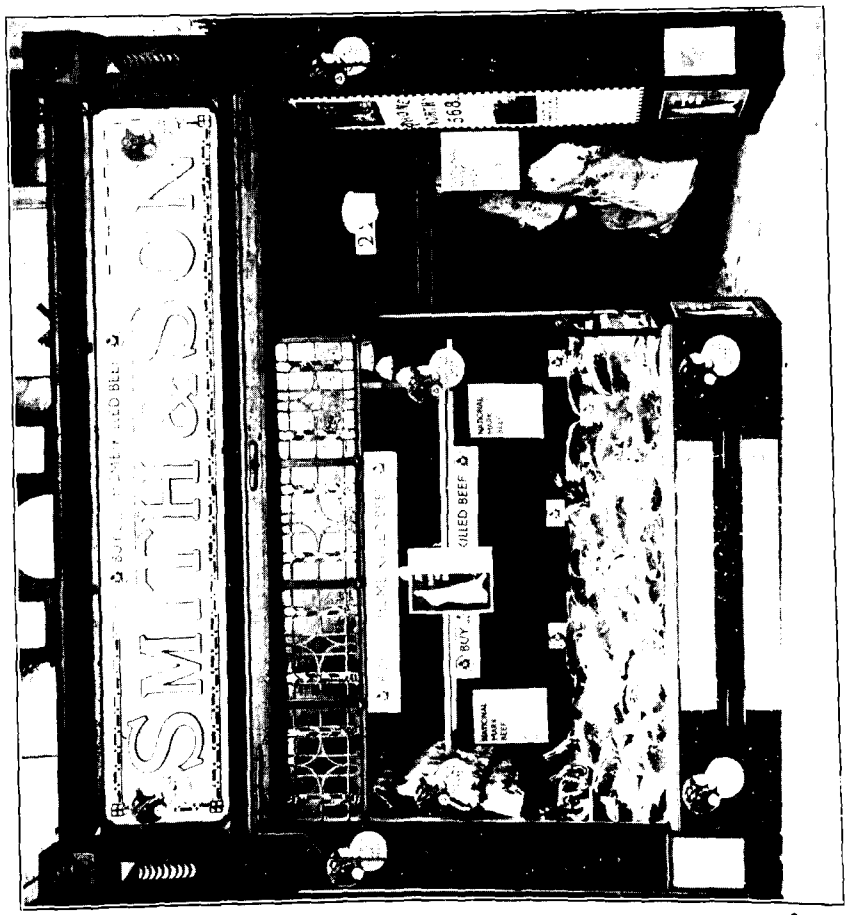
Publicity for National Mark Produce.—The Ministry's general programme of autumn and winter advertising was continued in December. The last two insertions in the series of advertisements in the national and chief provincial newspapers dealt with National Mark malt extract with cod-liver oil and National Mark canned fruits respectively, while a special Christmas appeal on behalf of National Mark beef was inserted in the London evening newspapers. Special advertising in newspapers circulating in the Eastern Counties was also continued, and the series was concluded shortly before Christmas. Advertising in trade journals covered National Mark beef, eggs, fruit, wheat flour, malt flour, malt extract with cod-liver oil, and canned fruits, peas and beans.

At the end of November, a personal letter from the Minister was sent to some 50,000 women householders in a part of south-west London, urging them to specify "National Mark" when purchasing any of the commodities referred to in the National Mark booklet, a copy of which was enclosed with the letter. Authorized packers of National Mark eggs, poultry, flour, canned fruits, and malt extract with cod-liver oil were notified of the dispatch of the letters, and also local butchers who regularly stock National Mark beef, grocers, dairymen, fruiterers and chemists. It was suggested to the local retailers that the Minister's letter provided a good opportunity to make special displays of National Mark products, for which liberal supplies of display material were offered.

At the beginning of December, a personal letter from the Minister was also sent to some 15,000 women householders in the Yardley Division of Birmingham, together with a copy of the National Mark booklet and an attractive new leaflet on the subject of National Mark beef, containing recipes for using up a joint of beef. The letter had special reference to National Mark beef, which, by means of press publicity and in other ways, was again well advertised in Birmingham during December. The press advertisements gave prominence to the window-dressing competition—reference to which was made in the December issue of this JOURNAL (p. 915). This competition was organized in four groups, on a district basis,



Group 2.—Mr. F. W. Wright, Mosely.



Group 1.—Messrs. G. A. Smith & Sons, Handsworth.

NATIONAL MARK BEEF: FIRST PRIZE WINDOW DISPLAYS AT BIRMINGHAM.

National Mark beef in their Christmas meat displays and offering to supply additional posters and other advertising material for this purpose.

H.R.H. the Duke of York visited the Ministry's National Mark Beef and Live Pig Exhibits at the Smithfield Club Fat Stock Show at the Royal Agricultural Hall, Islington, on December 8, and marked a side of beef on the Ministry's stand. A photograph of His Royal Highness, taken on the stand, is included in the accompanying illustration inset. After his visit to the Show, the Duke of York sent a letter to the Earl of Guilford, President of the Smithfield Club, in the following terms, in which the National Mark Beef Scheme is specially commended :—

145 Piccadilly,
W. 1.
December 8, 1930.

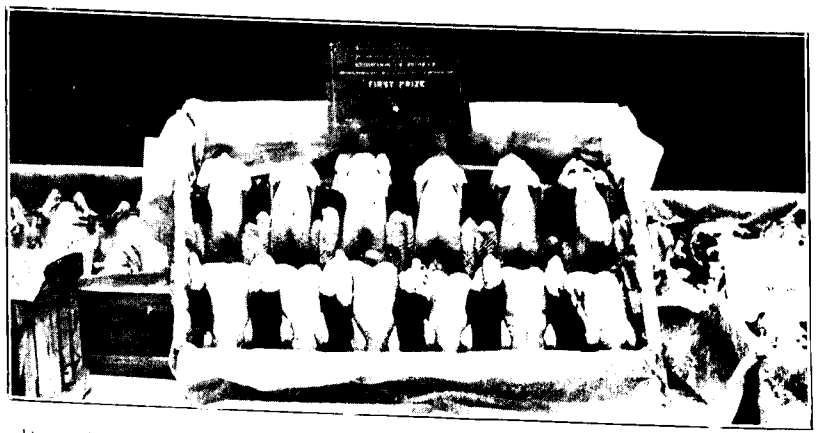
DEAR LORD GUILFORD,

It has been a great pleasure to me to visit Smithfield Show once again. The Smithfield Show is an outstanding event in the calendar, not only of the countryman but of the town dweller also, and it is no matter for surprise that it should be one of London's most popular autumn functions. But the Show is not only a magnificent spectacle ; it is an annual assertion and proof of the fact that the best British livestock is pre-eminent throughout the world, and I know how much this is due to the stimulating influence of the competitions organized by the Smithfield Club. I am glad to know that this year's Show is in every way worthy of the traditions established by its long line of predecessors, and I congratulate the Smithfield Club most heartily on the successful results of its enterprise and effort.

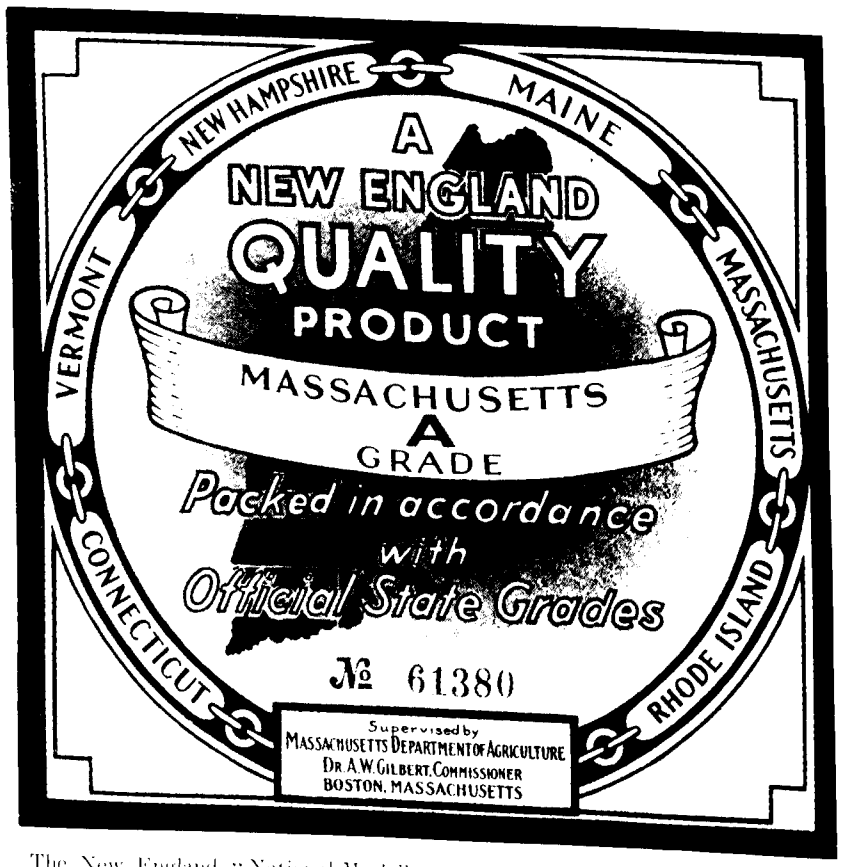
As a Vice-President of the Club, I take a special interest in the welfare of the cattle industry and in schemes for increasing its prosperity. A scheme which has for its object not only the general grading up of our livestock in this country, but also the improvement of meat marketing methods and the provision of a better service to the consuming public is therefore one that commends itself especially to me. For this reason, I was particularly interested in the display of National Mark Beef in the Gilbey Hall. I remember that my brother, the Prince of Wales, inaugurated the scheme at Islington Abattoir just a year ago, and I am very gratified to know that since then it has achieved a striking measure of success in London, where, I am told, practically the whole of the gradable supplies of Home-killed Beef on the Central Markets are, and have been for some time, graded and marked with the National Mark. It is clear that this progress could only have been achieved with the goodwill of all concerned, wholesaler, retailer, and consumer, and it is most encouraging to have such evidence of general support for a scheme which gives promise of help to our farmers and is at the same time a definite service to the public. I feel sure that the success of the scheme in London is a prelude to a similar result in Birmingham, a City which is not usually behind the Metropolis in adopting up-to-date methods, and I am glad to know that it is about to be extended to Leeds and Bradford.

H.R.H. The Duke of York inspecting the Ministry's display of National Mark Beef at the Smithfield Club Fat Stock Show on December 8, 1930. (See note on page 1016.)

Dressed Poultry Competition at the Gloucestershire Root, Fruit and Grain Show, 1930. General view of the display. (See note on page 1017.)



Dressed Poultry Competition at the Gloucestershire Root, Fruit and Grain Show, 1930. The Winning Exhibit in the Special Class for a market pack of 12 chickens. (See note on page 1017.)



The New England "National Mark" quality label. The label is printed in yellow and dark blue, the name of the State and Grade on the scroll, also the number, being over-printed in red. (See note on p. 1024.)

There are, of course, many other features of the Smithfield Show which are worthy of attention, but I have referred in particular to the National Mark Scheme because of its national importance and because I feel that it is an essential complement to the great work which the Breed Societies have done and are still doing for the British livestock industry. Efficient production deserves efficient marketing.

Yours sincerely,
(Signed) ALBERT.

Displays of Home Produce.—By the courtesy of the Secretary of the Institute of Certificated Grocers, a valuable opportunity for a display of Home and Empire commodities has been provided on the occasion of the occupation by the Institute of new offices at 50 Doughty Street, London, W.C. 1. A room has been set apart for a period of six months, during which various commodities of interest to the grocery trade will be displayed in succession. The first display, which was staged for the opening ceremony on November 20, 1930, consisted of canned home-grown fruits and vegetables.

Arrangements have also been made for the use of a show-case in the entrance hall of the Hippodrome Theatre, Birmingham, for a period of three months, during which various National Mark commodities are being displayed.

Marketing Demonstrations.—Marketing demonstrations were staged during December at :—

Birmingham Fat Stock Show :
Nov. 29-Dec. 4. (National Mark Beef.)
Smithfield Show :
Agricultural Hall, London. Dec. 8-12. (National Mark Beef and Commercial Pigs.)

Dressed Poultry Competition at Gloucestershire Show.—At the Annual Exhibition of Produce arranged in connexion with the Gloucestershire Root, Fruit and Grain Show, held at Gloucester in November last under the auspices of the Gloucestershire Education Committee, a special class for a market pack of 12 chickens was included in the schedule of competitions. One of the Ministry's marketing officers acted as judge of this class and was much impressed by the quality and appearance of the best entries. Great credit is due to the Education Committee and to the County Poultry Instructor for their interest in the movement towards the better marketing of dressed poultry and for instituting a competition class that will, without doubt, soon become a regular feature at other shows.

It may be of interest to indicate the system of scoring adopted which was found to work well. The points were allotted as follows :—

	Points
(1) Quality—*i.e.*, softness of breast meat	30
(2) Size with compactness	20
(3) Straightness of keel, fineness of bone and absence of surplus fat..	20
(4) Fine texture and colour of skin	15
(5) General finish and marketable appearance ..	15
Total	100

Photographs of the display and of the winning pack, which secured 92 points, are, by the courtesy of the Education Committee, reproduced in the inset facing page 1017.

Pig Industry Council.—The standard of quality of the pig supplies of this country is somewhat low; this weakness is accentuated by a lack of knowledge of market requirements, commonly resulting in the consignment of pigs to markets for which they are least suited. Moreover, the practice of selling live pigs by auction in ungraded lots renders it difficult for the producer to measure the influence of quality upon price.

The Pig Industry Council has, therefore, under consideration an experiment with the object of testing the practicability of grading live pigs before sale by auction, and hopes shortly to be in a position to discuss details with the interests concerned.

The Agricultural Marketing Bill.—The three main agricultural organizations in Scotland have declared their approval of the principles of the Agricultural Marketing Bill. The Scottish National Farmers' Union, at a meeting on October 10 last, re-affirmed their former support of the principle of organized marketing, but suggested that it would be handicapped without the control of imports; a Committee has been appointed to consider the clauses of the Bill in detail and to make suggestions. Since that date, a joint deputation of this body and of the Scottish Agricultural Organization Society has waited on the Secretary of State for Scotland and assured him that their organizations supported the basic principles of the Bill, subject to amendments that are now the subject of discussion.

The Scottish Chamber of Agriculture has also approved the principle of the Bill, by a good majority, subject to satisfactory provision being made against the frustration of a scheme by imports.

Reorganization of the Milk Industry.—On Thursday, November 20, 1930, Lord De La Warr, Parliamentary Secretary to the Ministry, received a deputation from the National Association of Creamery Proprietors to discuss proposals for reorganizing the milk industry. The discussion was of an informal character. The necessity for close co-operation between organized creameries and organized producers was emphasized by the deputation, but it was agreed that the comprehensive organization of milk producers under the Agricultural Marketing Bill was a necessary precedent to any satisfactory solution of the surplus problem, and the further development of the industry on sound lines.

Nova Scotia: Fruit Export Regulations.—The Canadian Fruit Export Regulations, made under Section 10 of the Fruit Act of 1927, came into force, in the Province of Nova Scotia, on September 20, 1930. The regulations provide that any fresh fruit (*i.e.*, apples, pears and plums) shall, before export, be subject to inspection and be certified to comply with all requirements of the Fruit Act and to be of the grade designated.

East Prussia: Cheese Control System.—Tilsit cheese, which corresponds in East Prussia to the Cheddar cheese of this country, is to become subject to a voluntary control system involving the use of an East Prussian trade-mark. The dairies that wish to make use of the mark will be subject to regulations drawn up by the Chamber of Agriculture for the province. These regulations will include a requirement that no cheese shall contain less than 45 per cent. of butter-fat in the moisture-free substance, and the stamping of defective cheese will not be permitted. The trade-mark will be placed both on the cheese itself and on the special packing to be adopted.

Grading and Marking of Beef in the U.S.A.—The beef grading and marking service in the United States, a note on which appeared in the September issue of this JOURNAL, is fully described in Leaflet No. 67, recently issued by the United States Department of Agriculture. The grading service was commenced experimentally at Chicago on May 2, 1927, and was eventually extended to eight other large centres. A permanent scheme was introduced on July 1, 1928, and a charge of $2 an hour was made for the grader's time, with a minimum charge of $1. Under favourable conditions, one man can grade from 60 to 75 carcasses an hour. On this basis, the cost of the service ranges from about 2¾ to 3¼ cents a carcass. The benefits of the service, as set out in the leaflet, are of interest:—

General.—Uninterrupted consumption of a product is largely dependent upon its conformity to certain recognized standards of quality.

Stockmen benefit primarily because the service ensures the sale of their finished product (beef) according to its standard of quality. If beef consumption is stimulated through more intelligent buying on the part of the consumer, it re-acts to the benefit of producers. Dealers have testified to increased sales since handling stamped beef.

Slaughterers and Packers.—Uniformity in quality of product, specially indicated by a label, increases confidence in purchases and tends to eliminate dissatisfaction and complaints. The service is, therefore, of material benefit to slaughterers and packers.

Wholesalers and Brokers.—The class and grade stamp on the beef is the Government's official statement of quality. When once a customer understands the significance of the grade terms, the time taken in placing orders is reduced to a minimum.

Retailers.—The retailer needs the confidence of the consuming public. This confidence is increased and the sale of products is helped if they bear identifiable grade stamps or marks signifying dependable quality. The grading service raises the standard of retail meat selling.

Hotels, Restaurants, etc.—Uniformity of the meat served in hotels and restaurants is of importance, as it often determines the reputation of a business of this nature. The proprietor can be reasonably certain of obtaining beef of the quality he wishes to serve by buying meat of the grade and class so stamped by the Government grader.

Housekeepers are assured of a degree of satisfaction commensurate with the grade of beef purchased. Beef possesses a wide range of quality which the average person is unable to distinguish. The Government's grade stamp is an assurance of quality and a means of identifying the various grades of beef.

The Advertising of Agricultural Produce in Germany.—The following abridged translation of an article that has recently appeared in a German agricultural journal* is an interesting survey of problems that are engaging attention not only in Germany but in this and many other countries. It is of particular interest and value to readers in this country in view of the broad similarity between agricultural marketing conditions in Germany and Great Britain.

If full use is to be made of publicity for agriculture it must comprise :—

I. Publicity to assist the sales of agricultural products—
   (1) directed towards the trade and the co-operatives ;
   (2) directed towards the consumer.

II. Publicity as a means of providing instruction and information within the agricultural industry—
   (1) to improve the adjustment of production to market conditions ;
   (2) to promote organization among producers.

Sales publicity is of outstanding importance. During the last decade, as a result of the increase in the national income and the

* Blätter für Landwirtschaftliche Marktforschung (Monatsschrift des Instituts für Landwirtschaftliche Marktforschung) : Berlin, October, 1930.

development of industries catering both for ordinary and for luxury requirements, together with often extraordinarily successful advertising, there has been a redistribution of expenditure in the family budgets of large groups of the population. Expenditure on foodstuffs has declined relatively to other expenditure, although absolutely it has risen. It is only to be expected that a part of the increasing purchasing power should find an outlet in satisfying those new wants, additional to the mere need of food, that have arisen ; but as the prosperity of the masses increases, agriculture must be especially concerned to see that an undue proportion of their increased purchasing power is not deflected from its own markets. If, however, publicity is desirable in times of prosperity, when a part of the increase of income goes in any case to raise the standard of food consumption, it is urgently needed in periods of depression, to ensure that as large a share as possible of the purchasing power of the public is retained for the markets for agricultural produce, and especially for high-class produce.

The great task of agricultural publicity is to produce in the psychological influences directed upon purchasers a balance that is fair to the agricultural industry. Abroad, this parity of industrial and agricultural publicity has to a great extent been achieved. More than 60 per cent. of the posters and bills in the New York subway advertise foodstuffs ; and in other forms of advertising in the U.S.A., food is usually very prominent. In Germany, on the contrary, only a diminishing share of all publicity employed is devoted to foodstuffs.

The reason why food is so widely advertised in the U.S.A. is to be sought in the fact that in that country large concerns are engaged in the trade in foodstuffs. Firms like Swift, Armour, Libby, Borden or the General Food Corporation have made sales publicity a central feature of their marketing policy, no less than the soap and cigarette concerns. In Germany, such propaganda in favour of agricultural produce is difficult, partly because these giant organizations are only found in the trade in certain imported foodstuffs, such as margarine and bananas, and not in the trade in German agricultural produce. To carry out publicity campaigns, therefore, the scattered forces of farmers, of co-operatives and also of the trade must be gathered together.

Propaganda for farm produce costs money ; and expensive methods of advertising costing hundreds of thousands of marks can only be undertaken by large organizations with ample supplies of capital. Moreover, except where special products are advertised, such publicity benefits not only the individual, but the whole farming community as well, so that the farmer is hardly prepared to spend considerable sums on advertising a product. *Thus, sales publicity, which is for the benefit of all, must be built up, not by individual effort, but like the farmers' market, upon a co-operative basis.* It remains none the less a matter for private enterprise. State assistance for agricultural publicity is required, but the chief costs must be borne by the parties interested—that is, by the farming community and agricultural societies, the trade and the co-operatives.

In particular, the agricultural co-operatives, which, as the trustees of the farmers, are interested in getting the best possible prices for their produce, are called upon to undertake this duty.

It is not only as regards finance that greater difficulties are encountered in advertising agricultural than industrial pro-

ducts. A further problem arises from the fact that sales publicity can only promise successful results if :—

(1) an accurate impression of the commodity is conveyed ;
(2) the quality of the commodity advertised strengthens the effect of the advertisement—that is, if the quality is good, consistent and reliable ; and
(3) the product is found by the purchaser to be good value.

For a large proportion of German agricultural products, conditions (1) and (2) are still lacking. There are, it is true, certain standard products of individual producing concerns, whose managements pay special attention to giving a consistent and reliable quality, but these have little significance, taking the market as a whole.

How seriously this lack of the essential conditions of effective publicity affects the ordinary products on the market can best be appreciated if the attempts to advertise rye bread, fruit or vegetables are compared with the advertisements of such reliable manufactured products as Henkel's steel knives, Faber's pencils, Persil, and so on. It is clear that unless the conditions mentioned above as regards quality and uniformity have been fulfilled, the sudden outbreak of a collective publicity campaign advertising something described in general terms as "ryebread," "fruit" or "vegetables" will only cause bewilderment.

Advertising can only become effective when linked with a guarantee of quality. If, as is generally necessary, the function of giving guarantees is reserved to the State, and takes the form of establishing a standard and maintaining it by official inspection, then the solution is simple—the advertising of agricultural produce must be strictly limited to guaranteed produce. It will be necessary to persuade the purchaser by means of uniformly distinguishable advertising matter that he can always be sure of getting best quality goods, guaranteed by a system of inspection, if only he buys the standard advertised products.

It follows from the above that the first step in a publicity campaign for German agricultural produce must be to seek out all the products for which the conditions already indicated hold good. An intensive campaign is at present possible only for commodities that are already standardized, such as Hanover Mark Potatoes, Schleswig-Holstein Mark Butter, Mannheim Bottled Milk, or similar products.

The next step must be to find out what producing districts are worthy of special publicity when advertising a given product.

About the media of publicity there can be little dispute. If the campaign is to be effective, all modern devices must be employed. These include :—

(1) the daily and trade Press ;
(2) the wireless ;
(3) films ; picture-strips in the schools and colleges ;
(4) illuminated signs, posters, shop-signs and displays ;
(5) the marking of goods with special brands ;
(6) the pattern and make-up of the packing.

In short, advertisement is essential if the sales of German agricultural products are to be increased or even maintained. Large-scale advertising can only be undertaken by large-scale organizations. Effective advertising demands a standardized article of guaranteed quality.

A New England "National Mark" Plan.—For a number of years, the United States Department of Agriculture has given much attention to the formulation of grades and standards for farm products. In some cases, notably cotton and wheat, the use of the official grades has been compulsory in inter-State commerce, but for the most part their use is still voluntary. In this work, the efforts of the Federal Government have been supplemented by those of the State legislatures, which have provided for the establishment of State grades—usually identical with the U.S. grades—for the chief products raised in their areas, and have made appropriations for the administrative and inspection services required.

Recently, a further step has been taken in marketing improvement by the introduction of marking or labelling schemes—resembling, in some respects, the National Mark schemes in this country—which seek to bring the consumer within the ambit of a standard grading system. It may, therefore, be of interest to give a brief outline of one of these schemes—the New England Farm Marketing Programme.

This scheme, like the National Mark schemes of this country, applies to an area which obtains the bulk of its food supplies from external sources. New England, however, is even more highly industrialized than old England, less than 10 per cent. of its population living on farms. This is no doubt largely due to the superior productivity of other areas in the United States and elsewhere ; but this is not the case with all the farm products raised in New England.

For the production of eggs, vegetables and certain fruits, New England has soil and climatic conditions as favourable as anywhere and has a great additional advantage in its close proximity to markets ; yet its share of the home market is annually declining in the face of the competition of supplies from distant areas, in many cases three thousand miles away.

In 1926, the New England Council, an organization formed for promoting the common interests of the six New England States, set its Agricultural Committee to work on the problem. The conclusion finally arrived at was that "the absence of a concerted marketing programme for New England producers has made effective opposition to such competition most difficult, and our hesitancy to adopt standard packs, uniform grades and proper identification of graded produce has retarded the sale of local produce to many local buyers demanding large quantities and uniform quality." A marketing conference was accordingly held in Boston at the end of the year which, "after due consideration of the problem, acknowledged the need for united efforts by all the New England States in a

programme that would outline grades for all the leading native-grown products and would make possible the standardization of packs and the identification and inspection of the strictly local-grown products graded to New England standards." The conference further suggested that each State should secure legislative authority to enable its Commissioner of Agriculture to promulgate tentative grades for a few of the more important products. Commodity groups were appointed to work out details.

At a second conference, held a year later, the design of the mark was established and grades were approved for eggs, apples, asparagus, celery, strawberries, bunch beets, carrots, turnips and globe radishes. These grades were recommended to the Commissioners of Agriculture for promulgation as State grades, all the New England States, with the exception of New Hampshire (which, however, ultimately came into line) having successfully put through the legislation enabling them to participate in a uniform New England marketing programme. As the demand arose, other commodities received attention, an effort being made to keep the State grades as uniform as possible.

The Commissioner of Agriculture in each State is authorized to adopt a label identifying the products graded and packed to official standards. The New England quality label (see illustration in inset facing page 1017), supplies of which are obtainable only through the Commissioners of Agriculture, is used for this purpose in all the States. A small charge is made for the labels.

In general, no preliminary qualifications are required of applicants for permission to use the labels. In New Hampshire, however, some form of inquiry is apparently made to ascertain that the applicant has a proper understanding of the programme and also the equipment for raising the product of the quality designated. In Connecticut, also, the regulations regarding the official "New-laid Fancy" egg grade require a rather rigid inspection of the poultry plant in so far as health and sanitation are concerned. Although permission to use the mark is not specifically limited to actual producers, the majority of the registered users are, in fact, either producers or producers' co-operative organizations. There is no qualification as to minimum output or turnover.

The need for protecting the reputation of the label is recognized. Each State Department of Agriculture maintains an inspection service of trained men whose duties are to

examine the graded and labelled products in the ordinary channels of trade and to satisfy themselves that the products thus identified meet the requirements of the grade. A substantial penalty provides against misuse, although the power to withdraw the privilege of using the labels is regarded as a sufficient safeguard in most cases. Inspection work is at present strictly on a State basis, but, with the rapid progress of the scheme, the question of providing an inter-State service has forced itself to the front.

No attempt has so far been made to make the scheme self-supporting. It is felt that while the scheme is in its infancy, most of the work can be handled by the existing staffs of the Departments of Agriculture. When the programme becomes firmly established, it is anticipated that all or a part of the costs of the service will be transferred to the users.

Some idea of the extent to which the programme has been adopted may be gathered from the following Table showing the number of users and the labels sold during the two-and-a-half years of its operation :—

NEW ENGLAND QUALITY LABELS ISSUED UP TO OCTOBER 1, 1930.

Type of Label	*No. of Users*	*Labels sold*
Apples	27	156,150
Eggs	422	2,924,725
Asparagus	39	157,000
Celery	3	165,000
Potatoes	26	63,950
Turkey	131	33,746
Baby chicks	47	10,700
Strawberries	65	13,250
Tomatoes	23	58,000
Jelly	1	1,000
Maple sugar	208	239,960
Honey	4	43,000
Butter	2	126,000
Lettuce	9	33,000
Total	1,007	4,025,481

In addition, 1,788,243 standard containers and markers were sold during the same period to 443 users.

It is difficult to say what price advantage is actually received by the producer whose supplies are marketed under the New England label compared with other producers, but a few figures are available. Fairly complete data on eggs sold in Rhode Island show that the near-by graded eggs, sold under the label, returned the producer approximately 5 cents a dozen more when sold wholesale, and 10 cents a dozen more when sold retail. In Maine, potatoes marketed under the

label commanded a premium of 10 cents per 100 lb. and apples of 50 cents a bushel. In Massachusetts, a co-operative organization calculated that the gains attributable to the use of the label on asparagus amounted to $206.98 per member on a season's pack. Apart from actual price premiums, all States reported that the use of the label assisted greatly in moving the produce on a glutted market and in ensuring a steady demand at all times.

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AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1930

Produce of Crops.—Apart from hay, the harvest of 1930 has proved unsatisfactory, particularly in comparison with the generally good results obtained last year. The corn harvest was adversely affected by the unfavourable weather conditions which prevailed during the greater part of August and September and, with the exception of beans, yields per acre have been materially below those of 1929. The yields per acre of wheat and barley were also less than the ten years' average. The lower yields obtained from areas which, for most corn crops, had been reduced, resulted in a total production which was substantially less than that of 1929. Potatoes were planted on a much smaller area than in the previous year, while the yield per acre, although slightly above average, was inferior to that of 1929. As a result the total production shows a marked reduction. The yields per acre of turnips and swedes and also of mangolds, although below the ten years' average, were much the same as in 1929, but the total production was somewhat lower owing to a reduction in the acreage.

Both seeds and meadow hay, however, gave yields per acre which showed a decided improvement over 1929, and were above the average. In addition, an increased area was cropped.

Corn Crops.—WHEAT.—The poor yield per acre more than counteracted the slight increase in the area under wheat, and the total production this year, which is estimated at 21,404,000 cwt., shows a reduction on the year of about 4 million cwt., or nearly 16 per cent. The yield per acre, estimated at 15·9 cwt., is 3·2 cwt. less than in 1929 and 1·8 cwt. below the ten years' average. Poor yields were general throughout the country, only seven counties obtaining over average results, and these were in areas where wheat growing is of minor importance. In the North-Eastern and Eastern divisions yields were as much as 3·2 and 2·7 cwt. respectively below the average.

PRELIMINARY STATEMENT SHOWING THE ESTIMATED TOTAL PRODUCE AND YIELD PER ACRE OF THE CORN, HAY AND ROOT CROPS IN ENGLAND AND WALES IN 1930, WITH COMPARISONS FOR 1929, AND THE AVERAGE YIELD PER ACRE OF THE TEN YEARS 1920–29.

Crops	Estimated Total Produce		Acreage		Estimated Yield per Acre		
	1930	1929	1930	1929	1930	1929	Average of the ten years, 1920–29
	Thousands of cwt.	Thousands of cwt.	Acres	Acres	Cwt.	Cwt.	Cwt.
Wheat ..	21,404	25,425	1,346,090	1,330,122	15·9	19·1	17·7
Barley ..	14,735	19,951	1,020,371	1,120,247	14.4	17·8	15·6
Oats ..	26,818	30,640	1,777,790	1,853,790	15.1	16·5	14·5
Mixed Corn	2,007	2,323	130,111	138,592	15.4	16·8	14·8
Beans ..	2,779	2,201	161,342	144,435	17.2	15·2	16·3
Peas ..	1,157	1,281	78,237	78,635	14·8	16·3	14·2
	Thousands of tons	Thousands of tons					
Seeds Hay*	2,321	1,746	1,595,462	1,523,692	29·1	22·9	27·7
Meadow Hay† ..	5,587	3,595	5,051,711	4,695,916	22.1	15·3	20·2
					Tons	Tons	Tons
Potatoes ..	2,741	3,588	424,408	518,813	6.5	6·9	6·2
Turnips & Swedes	7,928	8,304	669,977	697,878	11.8	11·9	12·5
Mangolds	5,441	5,687	288,004	298,690	18.9	19·0	19·1

* Hay from Clover, Sainfoin, and Grasses under rotation.
† Hay from Permanent Grass.

BARLEY.—Both the area and the estimated yield per acre of barley were well below the figures recorded in 1929, and the total production fell by over 5 million cwt. to 14,735,000 cwt., a decline of 26 per cent. Over the whole country the average yield was 14·4 cwt. per acre, a decrease of 3·4 cwt. compared with 1929 and 1·2 cwt. below average. Low yields were, however, by no means general, nearly one-half of the individual counties exceeding the average, but in the North-Eastern and Eastern divisions yields were below the average by 2·1 and 1·7 cwt., respectively.

OATS.—The yield per acre of oats, estimated at 15·1 cwt., showed a smaller decrease on the year than that of either wheat or barley, while, moreover, it was rather above the ten

years' average. The area harvested was somewhat less than in 1929, and the estimated total production at 26,818,000 cwt. was smaller by 12·5 per cent. On the whole, the most satisfactory yields per acre relatively were obtained in Wales, each Welsh county returning an over average yield. In the majority of the English counties also yields were rather above the average, but the North-Eastern division provided an important exception with under average yields in each county.

MIXED CORN.—The total production in mixed corn this year is estimated at 2,007,000 cwt., against 2,323,000 cwt. in the previous year, the reduction being caused by a combination of a smaller area and lower yields. The yield per acre at 15·4 cwt. was below that of 1929 by 1·4 cwt., although rather above the average.

BEANS.—The estimated yield per acre of beans harvested as corn was 17·2 cwt., a marked improvement compared with 1929, and about 1 cwt. per acre over the ten years' average. In addition, a larger area was harvested, and the total production at 2,779,000 cwt. was 26 per cent. more than in 1929.

PEAS.—The area of peas harvested as corn was much the same as in the previous year, but the estimated yield per acre fell by 1·5 cwt. to 14·8 cwt., which, nevertheless, was somewhat over the average. The total production at 1,157,000 cwt. showed a decline of 10 per cent.

Hay.—In the earlier part of the season conditions for the hay crop were unusually favourable, and yields per acre showed a marked improvement over those of 1929, and were above the average. Unfavourable weather conditions developed, however, towards the close of the harvest, and as a result a proportion of the crop in a number of districts was spoilt. For the most part the areas affected were in Wales and in the Northern part of England.

SEEDS HAY.—The crop of seeds hay is estimated to have yielded 29·1 cwt. per acre, an increase of over 6 cwt. compared with 1929, and 1·4 cwt. over the ten years' average. The crop was taken from a somewhat larger area, and the estimated total production rose by 575,000 tons to 2,321,000 tons. Over two-thirds of the counties secured over average yields, the remaining counties being situated mostly in Wales and the North of England.

MEADOW HAY.—The total production of meadow hay, estimated at 5,587,000 tons, exceeded that of 1929 by nearly 2 million tons, an increase in the area cropped being accompanied by much heavier yields. The yield per acre was

estimated at 22·1 cwt., or practically 7 cwt. more than in the previous year, and about 2 cwt. over the ten years' average. As is the case in seeds hay yields in several counties in Wales and the North of England were below average, but the majority of counties obtained over average results.

Potatoes.—With a reduced area and a smaller yield per acre the estimated production of potatoes at 2,741,000 tons is below that of 1929 by 847,000 tons, or 24 per cent. The yield per acre is estimated at 6·5 tons per acre against 6·9 tons in 1929, and the ten years' average of 6·2 tons. In most counties of the North-Western division, and also in the Isle of Ely and the Holland division of Lincoln, yields per acre were very slightly below average, but in the remaining parts of the country above average yields were general.

Roots.—TURNIPS AND SWEDES.—The yield of turnips and swedes, estimated at 11·8 tons per acre, was almost equal to last year's yield, but about two-thirds of a ton below average. The area was, however, reduced and the estimated total production declined from 8,304,000 tons to 7,928,000 tons. On the whole, the poorest results were obtained in the Northern division, where the yield was 2¾ tons below the average, deviations from the average being much less pronounced in the other divisions.

MANGOLDS.—The total production of mangolds is estimated at 5,441,000 tons, against 5,687,000 tons in 1929. The reduction was due mainly to a smaller acreage, the estimated yield per acre being nearly equal to that of 1929, although slightly below average. In North Wales, and in five of the English divisions, yields were above the average, but most counties in the Northern, North-Western and North-Eastern divisions returned under average yields.

SUGAR BEET.—The area under sugar beet has shown a further substantial increase, while, as far as can be estimated at present, the yield of washed and topped roots is likely to amount to about 9 tons per acre, against 8·7 tons last year. On this basis a crop of over 3,000,000 tons may be anticipated. Reports indicate that the sugar content is lower than last year.

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JANUARY ON THE FARM

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Arable Land.—Work on arable land is restricted. Stubbles not already moved should be ploughed, provided the weather is not too wet. Much harm can be done to heavy soils by working them under unsuitable conditions. Heavy land ploughed under wet conditions dries "steely" and hard unless mellowed by frost. The chances of severe frost after this month are reduced, although the prolonged frost in the spring of 1929 did not set in until the second week in February. Experience in that year clearly proved the value of frost in producing a good tilth, and no difficulty was experienced in getting a good seed bed for both corn and root crops. The spring of 1930 was almost the exact opposite; wherever land had been moved under wet conditions the tilth at seeding time was most unkind, and much extra work had to be done to bring the soil into a reasonable condition for sowing.

Soils vary to an extraordinary extent in workability. Light sandy soils may appear to work safely under all ordinary conditions, but many practical men assert that ploughing and working light soils during very wet weather conditions encourage finger-and-toe disease in turnips and swedes. Such soils are naturally more liable to grow diseased plants when there is deficiency of lime on such land, and when the farming practice is to grow swedes and turnips frequently in the cropping rotation.

The heavy sticky clays are the opposite extreme. The farmer must know his soil and the conditions under which it may be worked, or rather the conditions under which it must not be worked, if he is to avoid causing damage. Heavy soils that have been damaged by working under unsuitable conditions are difficult to handle, and a restoration of good physical condition may be accomplished only by numerous cultivations under good conditions, by frost or by summer fallow.

Frost to the extent required may not occur when the land is prepared for it, and even summer fallow conditions cannot be relied upon. There are large areas of heavy land that have been allowed to go out of cultivation and have tumbled down to most unsatisfactory grass in this spoiled physical condition. Heavy land is expensive to work at the best of times, owing to the limited number of days on which it is fit, but when spoiled by bad working the expense and labour are increased and the returns diminished.

Farmyard manure and lime or chalk have a good effect on texture and improve the friability of the soil, reduce the number of cultivations necessary to get a good tilth, and increase the number of days on which the land may be worked.

Under favourable weather conditions in the south, oats may be drilled this month, but it is not usual for much sowing to be done till February, and March is still more common. Where early sowing can be done any of the usual spring varieties can be used, but the variety Marvellous appears to be specially suited for really early sowing. For a number of years this variety of white oat was sown in autumn, and in mild winters was a complete success in the south, but it failed over very large areas in the winters of 1927-28 and 1928-29. Early sowing during January or February is specially suitable for this variety, and its strong straw reduces the chances of a laid crop at harvest.

Carting of farmyard manure is one of the main jobs during frosty weather. It is very desirable and a real help to get the manure to the field in which it is to be used, and to stack it in a large compact mix until it is possible to distribute it on the land and get it ploughed in. The practice of putting the manure in small heaps on the ground ready for spreading when the frost goes away causes depreciation of the manure. Loss will also occur in the mix, but the effect of farmyard manure is most pronounced when it is carted from the mix, spread over the land and ploughed in as quickly as possible.

Odd Jobs.—The slackness of work on the land makes available men and horses for odd jobs. The farm road must now be more than a mere cart track. A motor car requires a reasonable road, and whether the farmer owns a car or not, local tradesmen and milk lorries will avoid the farms and cottages where there is no easy access. Roads require more maintenance than formerly, and the wear and tear is heavier. In making or maintaining a road the most important thing is to get the surface water off as quickly as possible, as no amount of material will make a good road and stand the traffic if water is allowed to lie on it or to wash down the tracks.

Gateways into fields can now receive attention; the wear of stock or traffic creates low places at the gateways, and these collect water and rapidly deteriorate. It ought not to be necessary to say that the gateways should be kept well built up and dry, but the condition of very many gateways justifies calling attention to the matter.

Grass Land.—There is still time to put mineral manures on land that has been well fed down or severely harrowed. Fields that are expected to produce early grass should now be free of stock, although the application of nitrogeous manures may be delayed till later. Light soils may be rolled, but this work should not be done on heavy land under wet conditions. Many farmers prefer to roll when they can see that the roller is having some effect, but on heavy land injury may be done.

Sheep.—Sheep require special care at this time. It is an old saying that as the day lengthens the cold strengthens. Wet and cold conditions and the short day are a severe handicap to the sheep, and they require more food than at any other season. Some dry food is of real value, and sheep on roots should have hay or grain and cake. Grass sheep vary in their requirements according to conditions, but where supplementary foods are to be given the animals should not be allowed to get down in condition before one begins to feed them. Once feeding is commenced it should be continued until the grass makes good growth. Fattening sheep on roots benefit by a supplement of hay, and if they are to be finished early cake and corn will be necessary. Early breeding sheep will soon be lambing and demand the greatest skill of the farmer and shepherd. Feeding must be suitable and liberal. This is very special work, and whether the aim is ram breeding or the early fat lamb trade special prices are required to reward the skill and expense involved. The milking capacity of the ewe is an important feature in the early life of the lamb. Observations and tests of the milking capacity of the ewe are difficult, except by judging the lamb, and this is masked by the inherent capacity of the lamb to make use of the milk. The dairy cow has been accurately observed and studied, and a few of the main factors no doubt apply to sheep.

The first feature of importance is that the milking capacity is inherited. Breeds of the mountain type of sheep have a reputation for being better milkers than lowland breeds, and this no doubt is a result of selection under conditions where supplementary feeding of the lamb is not practised. The effect of a poor milking mother would be to diminish the chances of its offspring being good enough to be saved for the flock.

Feeding and management of the cow can account for big differences in yield. Balanced and controlled rations are the

every-day practice in well-managed herds, and, while it is not possible to measure accurately the day-to-day yield of the ewes or to feed them individually, a few general methods applicable to the dairy herd may have some application to the nursing ewes. Feeding of concentrates before roots and roots before hay has a natural tendency to prevent the animal overloading its stomach, and promotes better digestion. Constant access to clean water is also important, as the greater the yield of milk the greater is the need for water. With cows, over four gallons of water are taken up for each gallon of milk produced.

Frozen roots and ice-cold water are distinctly harmful to milk production, and with ewes this may be a real difficulty at this season of the year. Much has been said about the effect of roots on the milk yield of cows, and without entering into controversy it may be assumed that roots will still produce milk in excess of the requirements of the offspring, and with sheep some laxative green food is valuable and necessary. The quantity should not be excessive; where it is restricted a supply of water is of great importance.

Cattle.—Cattle wintered outside will require more food now if they are to maintain their condition. Grass is rather inferior, and if frosts are prevalent some hay or good straw will be necessary. A few roots will be appreciated. Cake or grain supplements are of doubtful value when given in addition to hay or good straw and roots. Outwintered cattle that have had no concentrated food in winter are in a position to make the best possible use of the early spring grass, and the cost of concentrated foods may not be recovered.

Cattle in yards or tied up cannot safely be turned out till the weather is favourable, and they do not get the full advantage of early grass. In such circumstances concentrated foods are justified, and should be sufficient in amount to produce a difference in the appearance of the animals, particularly if they are being prepared for sale. Roots and straw or hay will bring the older cattle through the winter cheaply, and 2 lb. of concentrates per head per day may make so little difference as to be unprofitable, whereas 4 lb. per head per day might produce that bloom and thriving condition that is attractive in the sale ring. Such statements may seem contradictory, but very moderate feeding of concentrates may often be uneconomical where more liberal feeding would give good returns.

NOTES ON MANURES

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Manures for Clovers.—Both from the point of view of the maintenance of humus and also the improvement in tilth due to the crumbling effect of its mass of fibrous roots, the seeds ley is a great asset in arable farming. If at the same time the leguminous plants of the seeds mixture can be stimulated into vigorous growth, a very real addition to the soil nitrogen supply is secured. This extra nitrogen, becoming available for the crops which follow, represents a definite gain in fertility. Cases are by no means rare in which cereal crops following ploughed-up leys which were very rich in clover have shown the signs associated with too much nitrogen. There is one principle in manurial practice which really holds over a very wide set of conditions: a good supply of mineral fertilizers, phosphates, potash and lime, greatly assist the leguminous plants in their competition with the grasses. Numbers of botanical analyses of the herbage from pasture of all kinds, both permanent and temporary, and also experience with forage mixtures of cereals and leguminous crops, have demonstrated this. As an illustration it may be in place to quote the results from the Park Grass plots at Rothamsted, where various mineral fertilizers have been used on a series of plots for many years.

BOTANICAL COMPOSITION AND YIELD OF FIRST CROP

	Average 1921–1924			
	Grasses per cent.	Clovers per cent.	Weeds per cent.	Yield cwt. per acre
No manure ..	62	7	31	14
Lime	58	10	32	14
Minerals* ..	64	18	18	27
Minerals with lime	54	36	10	34

* Superphosphate and sulphates of potash, soda and magnesia.

While lime alone has not produced much effect either in the quantity of the herbage or the amount of leguminous plants, the use of minerals has more than doubled the proportion of clovers and also doubled the total yield. At this stage the further addition of lime now doubles the amount of legumes and also appreciably increases the yield. It is interesting to examine the effect of the individual constituents of the mineral mixture on the composition of the hay. This can be seen from the results of the botanical analyses over a series of years, 1903-1919.

PERCENTAGE OF LEGUMINOUS HERBAGE*

	Lowest	Highest
Phosphate, potash, soda, magnesia	8·7	33·2
Phosphate, soda, magnesia ..	2·7	20·3
Phosphate	2·6	17·6

It is clear that under the continuous hay-cutting conditions of the Rothamsted plots, which are highly unfavourable to a persistent growth of clover, the use of phosphate alone is insufficient to maintain a high proportion of leguminous herbage in the turf. This is not greatly improved by the addition of sodium and magnesium salts (which occur in ordinary practice as the impurities in low-grade potash salts). On the other hand, the further addition of potash produces a marked effect in increasing the clovers. In normal circumstances, where grazing is practised periodically during the life of the turf, even more pronounced responses of leguminous plants to these manures may be expected; for not only is the shading-out of clovers much less severe, but the bulk of the potash removed from the land is returned as manure. Moreover, if the soil is naturally rich in one or more of these constituents artificial addition will be unnecessary. On many soils this is true of lime; on good clay soils where dung is occasionally given potash should not be required, and a source of phosphate such as basic slag should give excellent results with the clovers. An increasing number of cases are coming to the notice of farmers in which a potash dressing is necessary in addition to the phosphate in order to maintain the quality of the turf or to secure a good sole of clover in a ley. Potash salts of the 20 or 30 per cent. grade are quite suitable for this purpose, and may be mixed with basic slag or with rock phosphate when the latter has proved itself to be effective. A usual scale of dressing for the leys or for permanent grass would be about 4–6 cwt. of 30 per cent. basic slag or its equivalent, with 2 cwt. of 30 per cent. potash salts or its equivalent of the 14 or 20 per cent. grade, where potash is known to be helpful. The need for lime is best decided on the basis of a sample analytical test carried out in conjunction with the County Agricultural Organizer.

Dressings such as the above may be supplied in winter or very early in spring at a time when the grass is short.

Quality in Barley.—In a recent paper† dealing with his work at Rothamsted on the nitrogen content of barley and its influence on quality, Dr. L. R. Bishop has discussed the effects

* W. E. Brenchley, *Manuring of Grassland for Hay*, 1924.

† The Nitrogen Content and Quality of Barley: *J. Inst. Brew.*, XXXVI, 1930, pp. 352–569.

of manuring, soil and season on the quality of barley in a way which serves to explain certain views which are widely held by growers. On the other hand, he has pointed out various erroneous ideas which have gained acceptance. It may be of interest to give some of his main conclusions from the parts of the paper dealing with the more practical side of the question.

Starting from the view that the nitrogen content of the grain is a very good index of market value, *i.e.*, within certain limits the lower the nitrogen the better the barley, it is important for growers to realize the factors that make for a low nitrogen percentage in the grain, or the reverse. It should be borne in mind that if two barleys take up equal amounts of nitrogen from the soil and one makes more carbohydrate (starch) in the grain than the other the first will have a lower percentage of nitrogen in the grain than the second, although the actual amount of nitrogen may be equal. Hence production of carbohydrate tends to lower the percentage of nitrogen in the grain and has a favourable influence both on yield and quality.

Under ordinary conditions of farming it has been shown repeatedly that of the three common fertilizer constituents, nitrogen has by far the most potent effect in increasing the yield of barley. The period in the life of the plant at which this nitrogen is supplied is, however, of very great influence on the quality of the resulting grain. What is wanted is a good supply of nitrogen in an available form at the early stages, to stimulate vegetative growth and form an adequate leaf-surface which in turn can build up abundant carbohydrate to be passed on to the seed. The barley soil should be rich in nitrate in the spring, rather than later on in the season. Nitrogenous manures are best given in the spring in the seed bed, or at any rate in very early top dressings. In this way, given favourable weather conditions, nitrogen increases the yield without raising the percentage of nitrogen in the grain. Therefore a good yield and high quality are not, as is sometimes supposed, incompatible. On the other hand, nitrogen applied as later top dressings, or coming into action late in the season, tends to raise the percentage of nitrogen in the grain by failing to produce a counterbalancing yield increase.

This happens in very rich organic soils, or soils plentifully supplied with farmyard manure or the residues of heavy sheeping. The last two cases are well recognized by growers as productive of low quality barley.

This action of a late supply of nitrogen also explains the association of poor quality with an abundance of small immature grains, these being the result of the survival of late tillers that would never have made grain at all had it not been for the presence of abundant nitrogen in summer. Also, the effect of wide spacing in reducing the quality can be assigned to the same cause, as the roots have greater soil volume to search for nitrogen and therefore continue to take it up later in the season.

The other side to the question is the production of carbohydrate. High yielding varieties tend to have a lower nitrogen content than those that produce less ; similarly early varieties with their shorter period of growth tend to be higher in nitrogen than the later sorts with their longer assimilative phase. Late sowing, by cutting down the period of active assimilation, has the effect of raising the nitrogen percentage, as also does any serious check in growth due to drought at a time when the rapid building up of starch should be taking place.

The weather is of course a vital factor in the growth of any crop. In the above paper the conclusions are summarized from several statistical studies concerning the effect of season on the growth of barley, and explanations are suggested for the observed effects. A dry March and April benefit yield, probably as the result of early sowing in a dry seed bed and also of the conservation of nitrate. A low temperature in May is also beneficial. In this case the prolongation of the assimilative phase helps the yield ; conversely, if hot weather sets in in May the energies of the plant are diverted from assimilation to translocation with consequent reduction of yield. Rain in June and July is an advantage in the drier parts of England ; here the effect is no doubt associated with the postponement of the ripening process and prolongation of the passage of starch to the grain. The converse condition to this is premature ripening which admittedly cuts down the yield.

Early Spring Oats.—Those who sow spring oats very early in the year to escape the danger of frit fly should consider whether the young plants will find sufficient phosphate to help them to get established early. Unless a generous application has been made to the previous crop the application of 2 cwt. of superphosphate or basic slag would be desirable. Only on light soils would potash be required, when 1 cwt. of 30 per cent. potash salts might be used as well as the phosphate. In this case, if part of the superphosphate were replaced by steamed bone flour a drier mixture would result. If nitrogen is required—and this will usually be the case—at this time of the year the choice might be restricted to a light dressing of either sulphate of ammonia or cyanamide, as nitric nitrogen would quite probably be washed out before the crop was in full growth. The

remainder of the nitrogen could be reserved for a top dressing either as nitro-chalk or nitrate of soda later in the spring. Not only will the phosphate help to give the plant a good start, but a moderate dose of nitrogen in the seed bed will help in the same direction.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended December 12				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) .. *	9 15*d*	9 15*d*	9 15*d*	9 15*d*	12 7
Nitro-chalk (N. 15½%) .. *	9 7*d*	9 7*d*	9 7*d*	9 7*d*	12 1
Sulphate of ammonia :— Neutral (N. 20·6%) .. *	9 5*d*	9 5*d*	9 5*d*	9 5*d*	9 0
Calcium cyanamide (N. 20·6%) *	8 11*e*	8 11*e*	8 11*e*	8 11*e*	8 3
Kainit (Pot. 14%) .. .. §	3 6	2 10	2 18	3 3	4 6
Potash salts (Pot. 30%) .. §	5 3	4 8	4 18	4 17	3 3
,, (Pot. 20%) .. §	3 15	3 0	3 7	3 10	3 6
Muriate of potash (Pot. 50%) §	9 12	9 0	8 18	9 5	3 8
Sulphate,, ,, (Pot. 48%) §	11 13	11 2	10 19	11 5	4 8
Basic Slag (P.A. 15¾%)‖ .. §	2 13*c*	2 3*c*	..	2 9*c*	3 1
,, (P.A. 14%)‖ .. §	2 7*c*	1 16*c*	1 16*c*	2 3*c*	3 2
,, (P.A. 11%)‖ .. §	..	1 9*c*	1 9*c*	..	..
Ground rock phosphate (P.A. 26-27½%)‖ .. .. .. §	2 2*a*	2 10*a*	2 5*a*	2 7*a*	1 9
Superphosphate (S.P.A.16%) §	3 11	..	3 9	3 6	4 2
,, (S.P.A.13¾%) §	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3¾%, P.A.20½%) §	8 15	8 10	8 7	6 12	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%) .. .. §	5 17*b*	5 15*f*	5 15	4 7	..
Burnt Lump Lime .. .. §	1 5*l*	1 2*m*	1 9	1 17*h*	..
Ground Lime .. .. .. §	1 12*l*	1 8*m*	..	1 12*h*	..
,, Limestone .. .. §	1 3*l*	1 6*g*	1 8*k*	..	..
,, Chalk .. .. .. §	..	1 6*g*	..	1 11*h*	..
Slaked Lime .. .. .. §	..	..	2 9	2 17*h*	..

Abbreviations: N.=Nitrogen; P.A.=Phosphoric Acid; S.P.A.=Soluble Phosphoric Acid; Pot.=Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 80%, through standard sieve. *a* Prices for 6-ton lots f.o.r. at makers' works.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

g F.o.r. Knottingley. Ground limestone 100% through standard sieve.

h Carriage paid 6-ton lots London, bags included.

k In bags, f.o.r. Liverpool. Fineness 45% through standard sieve.

l Carriage paid 6-ton lots Bristol.

m Carriage paid 6-ton lots Knottingley.

NOTES ON FEEDING STUFFS

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Effects of Protein and Calcium Deficiency in Pig Rations.—Probably the chief factor in determining success in pig breeding (as, indeed, in the breeding of all farm stock) is prolificacy. Improvement of type is obviously good, but progress in that can be judged by the eye, and is constantly stimulated by our show system. Fertility, however, is more a matter of book-keeping, and it is doubtful if it receives sufficient attention. That this characteristic of fertility is heritable has been established by a large amount of observation and experiment, and the system of pig-recording, only lately introduced into this country and described in this JOURNAL for November, 1929, shows how important is the part it plays, and how it promises to assist very materially in improving fertility in the near future.

The whole subject of fertility in animals is an interesting one, but it presents difficulties, because, though the essential processes are similar, the agricultural problem of improvement differs from species to species. In general the number of young produced depends primarily on the number of eggs produced by the female, and it would be supposed that in an animal like the sow, which has large litters compared with others, this would be the determining factor. Curiously enough inquiry has shown that this is not the case. Normally the sow produces plenty of eggs, and these are nearly all fertilized and start to develop, but often a considerable proportion of them will go wrong during pregnancy. Some degenerate very early and usually pass unnoticed in the afterbirth at farrowing, others develop to a fair size and then go back, whilst the "dilling" of the litter may be one that has just, but only just, lasted over the period of gestation, and starts life with a big handicap. The number of "wrong uns" (known scientifically as atrophic foetuses) varies very much from litter to litter, and it has been shown that fertility is very largely dependent on it. It therefore follows that the problem of raising the litter size hangs on the avoidance of atrophic foetuses, and that the first thing for the scientist to do is to find out what causes this condition. Absence of a vitamin (E) has been shown to lead to degenerate foetuses in rats, but in that case all the foetuses die, and not merely a proportion of them. Further, in practice Vitamin E deficiency can hardly ever occur, so that it appears that the solution can scarcely be found along that line.

It is being established beyond all doubt that degeneration of foetuses is a heritable characteristic, and with pigs it appears that heredity plays its part in fertility by this means. Nevertheless, on the face of it external factors might very well affect the proportion that degenerate, so that research on the physiological side is obviously needed. The results of one exhaustive inquiry on these lines have just been published by Mr. Davidson, now of the Rowatt Research Institute, though the work was done at Cambridge from 1921 to 1928.

Essentially the design of the experiment was simple, though, as with all records of breeding experiments carried on for several generations, the paper seems a little complicated at a first glance. Three rations were drawn up, one of which was a normal complete ration, one was similar except that the protein was definitely lower and below the minimum requirement, and the other was again similar except that it was deficient in calcium. Separate groups of pigs were fed on these rations through two or three generations, and great care was taken to ensure that the animals picked up nothing else—*e.g.*, the calcium-deficient pigs had no chance to get a mouthful of soil. The main result of the experiment may be very easily stated. It was found that protein deficiency did not increase the number of degenerate foetuses, and that neither did calcium deficiency raise it noticeably, though it might play the part of a small contributory cause, and it did lead to a greater number of fully developed piglings being born dead.

Other interesting observations were made on the effects of feeding the two abnormal rations. Protein deficiency led to stunting and unthriftiness, and the effects developed to the full at once and got no worse in the succeeding generations. With calcium deficiency, however, things went from bad to worse, and the whole group would probably have died out had the experiment been continued a little longer. The first generation suffered, and the second started life with an inadequate supply, received milk from their mothers which was deficient in this element, and had their condition further aggravated by the ration they received subsequently. Though some of the symptoms shown by this group probably developed as secondary ones, the general condition was one of extreme thriftlessness. Characteristic symptoms were emaciation, coarse hair, scurfy skin, hunched back, overgrown forehead, and protruding eyes. Perhaps the most striking effect of calcium deficiency occurred in connexion with the sows' milk yields; the glands did not develop to anything like the normal

extent, and the very reduced yield of milk was reflected in the poor rate of growth of the young pigs while suckling. In addition, accidents were very common in this group; a number of pigs had to be slaughtered as a result of broken bones, owing to such trivial things as slipping on the floor.

An interesting point noticed in the protein-deficient group was that there was a delay in coming on heat; the average time from weaning the previous litter to the first subsequent heat was nearly five weeks, as compared with approximately two weeks in the other two groups. This would appear on the surface to be in conformity with the results obtained in flushing ewes, where it is found that by high feeding the heat period is advanced, and that protein-rich foods are very efficient in this respect. After a careful consideration of the details, however, Mr. Davidson rejects this explanation. The control ration contained most of its protein in the form of blood meal, which formed some 7 per cent. of the ration, and this was the constituent dropped to obtain the protein-deficient ration. As this meal has a considerable mineral content a mineral mixture was added in its place to make up, but that mixture could not be obtained in the earlier stages of the experiment. When the mineral mixture was not available the delay in coming on heat in the group not receiving blood meal was very marked, but the subsequent addition of the mineral mixture did much to remedy this. Mr. Davidson therefore concluded that the delay in heat was caused by the absence of some mineral or minerals—possibly potassium and iron—which the blood meal provided for the other groups. In support a herd is quoted where there was evidence of mineral deficiency, and where this was accompanied by unduly long intervals between farrowings. It might be added that blood meal was found to cause serious diarrhœa with young pigs, but was considered a fairly useful source of protein for older pigs.

Sows' Milk Yields.—Four German workers have recently published the results of inquiries they have made into the amount and composition of the milk produced by sows in raising litters. In one trial 14 improved German sows produced milk varying from 277 lb. to 490 lb. during a suckling period of 10 weeks; one Berkshire included with this lot gave 482 lb. and so compared well with the German sows. The yield rises slowly for about four weeks (very roughly from 6 lb. to 8 lb. per day) and then tails off. Front teats

yield more than rear ones and there is a correspondingly greater increase in weight of those piglings suckling them, each pigling usually settling down to one particular teat in three or four days and keeping to it. On the average the litter increases nearly 1 lb. in live weight for every 3 lb. of milk. Sow's milk is very rich, as it contains round about 7 per cent. of fat and over 6 per cent. of protein. The composition varies largely from sow to sow and also from teat to teat in the same sow, but there is no definite trend in composition from the fore to the rear teats.

During lactation sows lose largely in their own body weight; this loss occurs principally in the first few weeks and may amount to anything from 20 lb. upwards. Experiments showed that the sows' loss in body weight was less by 20 per cent., and the milk yield greater by 40 per cent., when a high protein ration (nutritive ration of 1 : 4·9) was fed, than when a low protein ration (nutritive ratio of 1 : 9·2) was used. If the sow is to be highly productive she must not only have a large litter of the right sort of pigs, but must also provide a plentiful supply of milk for them. Except in experiments it is impossible to ascertain how much milk a sow is giving, but the yield is fairly accurately shown by the increases in the weights of the piglings in the first few weeks. The weight of the litter at, say, six weeks old measures both the fertility and the milking capabilities of the sow together (plus an unknown inheritance from the boar). Pig-recording will, therefore, help in picking out the high-milk-yielding sows, and, as far as the experience of the German workers goes, it seems that there is very wide variation, and consequently much chance of effecting an improvement.

* * * * * *

DESCRIPTION	Price per qr.		Price per ton	Manurial value per ton	Cost of food value per ton	Starch equiv. per 100 lb.	Price per unit starch equiv.	Price per lb. starch equiv.	Protein equiv.
	s. d.	lb.	£ s.	£ s.	£ s.		s. d.	d.	%
Wheat, British	—	—	6 12	0 11	6 1	72	1 8	0·89	9·6
Barley, British feeding ..	—	—	5 15	0 9	5 6	71	1 6	0·80	6·2
„ Danubian	17 0	400	4 15	0 9	4 6	71	1 3	0·67	6·2
„ Persian	15 9	„	4 8	0 9	3 19	71	1 1	0·58	6·2
„ Russian	16 0	„	4 10*	0 9	4 1	71	1 2	0·62	6·2
Oats, English, white	—	—	6 0	0 9	5 11	60	1 10	0·98	7·6
„ „ black and grey	—	—	5 15	0 9	5 6	60	1 9	0·94	7·6
„ Canadian mixed feed ..	12 9	320	4 10*	0 9	4 1	60	1 4	0·71	7·6
„ Chilian tawny	14 3	„	5 0	0 9	4 11	60	1 6	0·80	7·6
„ German	24 3	„	8 10*	0 9	8 1	60	2 8	1·43	7·6
„ Russian	15 0	„	5 5	0 9	4 16	60	1 7	0·85	7·6
Maize, Argentine	20 3	480	4 15	0 9	4 6	81	1 1	0·58	6·8
„ South African	18 6	„	4 7§	0 9	3 18	81	1 0	0·54	6·8
Beans, English Winter ..	—	—	5 15§	1 2	4 13	66	1 5	0·76	20
Peas, English Blue	—	—	8 0§	0 19	7 1	69	2 1	1·12	18
„ Indian	—	—	9 5†	0 19	8 6	69	2 5	1·29	18
„ Japanese	—	—	16 5†	0 19	15 6	69	4 5	2·37	18
Dari	—	—	8 0	0 10	7 10	74	2 0	1·07	7·2
Milling offals—									
Bran, British..	—	—	5 5	1 0	4 5	42	2 0	1·07	10
„ broad	—	—	6 0	1 0	5 0	42	2 5	1·29	10
Middlings, fine, imported ..	—	—	5 15	0 15	5 0	69	1 5	0·76	12
„ coarse, British ..	—	—	5 5	0 15	4 10	58	1 7	0·85	11
Pollards, imported	—	—	4 10	0 19	3 11	60	1 2	0·62	11
Meal, barley	—	—	6 0	0 9	5 11	71	1 7	0·85	6·2
„ maize	—	—	6 2	0 9	5 13	81	1 5	0·76	6·8
„ „ South African ..	—	—	5 10	0 9	5 1	81	1 3	0·67	6·8
„ „ germ	—	—	5 17	0 14	5 3	85	1 3	0·67	10
„ locust bean	—	—	6 0	0 7	5 13	71	1 7	0·85	3·6
„ bean	—	—	8 15	1 2	7 13	66	2 4	1·25	20
„ fish	—	—	18 0	2 18	15 2	53	5 9	3·08	48
Maize, cooked flaked	—	—	7 0	0 9	6 11	83	1 7	0·85	8·6
„ gluten feed	—	—	6 7	0 18	5 9	76	1 5	0·76	19
Linseed cake, English, 12% oil	—	—	9 12	1 6	8 6	74	2 3	1·20	25
„ „ „ 9% „	—	—	9 1	1 6	7 15	74	2 1	1.12	25
„ „ „ 8% „	—	—	8 17	1 6	7 11	74	2 0	1·07	25
Soya bean cake, 5½% oil ..	—	—	7 7*	1 17	5 10	69	1 7	0·85	36
Cottonseed cake—									
„ „ English, 4½% oil	—	—	4 5	1 5	3 0	42	1 5	0·76	17
„ „ Egyptian, 4½% „	—	—	4 0	1 5	2 15	42	1 4	0·71	17
Decorticated cottonseed meal, 7% oil	—	—	9 5*	1 17	7 8	74	2 0	1·07	35
Ground-nut cake, 6-7% oil ..	—	—	5 5§	1 5	4 0	57	1 5	0.76	27
Decorticated ground-nut cake, 6-7% oil	—	—	7 5§	1 17	5 8	73	1 6	0·80	41
Palm kernel cake, 4½-5½% „	—	—	5 15§	0 16	4 19	75	1 4	0·71	17
„ „ „ meal, 4½% „	—	—	6 5§	0 16	5 9	75	1 5	0.76	17
„ „ meal 1-2% oil ..	—	—	4 12	0 16	3 16	71	1 1	0·58	17
Feeding treacle	—	—	5 15	0 8	5 7	51	2 1	1·12	2·7
Brewers' grains, dried ale ..	—	—	4 2	0 16	3 6	48	1 5	0·76	13
„ „ „ porter ..	—	—	3 15	0 16	2 19	48	1 3	0·67	13
Malt culms	—	—	5 10†	1 5	4 5	43	2 0	1·07	16
Dried sugar beet pulp (*a*) ..	—	—	4 15	0 8	4 7	65	1 4	0·71	5·2

* At Bristol. † At Liverpool. § At Hull. (*a*) Carriage paid in 4-ton lots.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of November and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £7 per ton, then since its manurial value is 16s. per ton as shown above, the food value per ton is £6 4s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 1s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0·89d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 8s. 3d.; P_2O_5, 2s. 11d.; K_2O, 3s. 3d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6·2	4 11
Maize	81	6·8	4 11
Decorticated ground nut cake	73	41·0	7 5
" cotton cake	71	34·0	7 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·17 shillings, and per unit protein equivalent, 1·81 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1930, issue of the Ministry's JOURNAL.)

FARM VALUES

Crops	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	5 2
Oats	60	7·6	4 4
Barley	71	6·2	4 14
Potatoes	18	0·6	1 2
Swedes	7	0·7	0 9
Mangolds	7	0·4	0 9
Beans	66	20·0	5 13
Good meadow hay	37	4·6	2 12
Good oat straw	20	0·9	1 5
Good clover hay	38	7·0	2 17
Vetch and oat silage	13	1·6	0 18
Barley straw	23	0·7	1 8
Wheat straw	13	0·1	0 15
Bean straw	23	1·7	1 10

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2. Price 6d. net.

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MISCELLANEOUS NOTES

The International Year Book of Agricultural Statistics

THE International Institute of Agriculture at Rome has recently published the 1929-30 edition of the International Year Book of Agricultural Statistics.

This volume of about 800 pages is the result of the most extensive and detailed inquiry made in the domain of international agricultural statistics and constitutes a work of the greatest importance to all those who are interested in questions having a direct or indirect relation to the production of and commerce in agricultural products.

Figures for area and population of 220 countries, in the years nearest to 1913 and 1929, are classified in the first part of the Year Book. The presentation of these figures throws light upon the world situation from the geographical and political points of view during both the pre-war and post-war periods. The second part of the Year Book is composed of a series of tables comprising for nearly 50 countries the available data concerning the uses for which the total area is employed, the apportionment of cultivated areas between the different crops, agricultural production, numbers of the different kinds of livestock and the products derived from them. In the tables constituting the third part of the volume, the area, production and yield per acre in each country during the last five years of the pre-war period and during each of the years from 1926 to 1929 for nearly 40 agricultural products have been given.

For each kind of livestock, all available figures in the different countries have been grouped for the years 1913 and 1925 to 1929. A large part of the volume is devoted to statistics of the commercial movement of 42 vegetable products and 12 products of animal origin. The figures published relate to the imports and exports during the calendar years and for the cereals also during the commercial seasons.

It may be added that the tables of production and commerce not only specify details for each country but also the totals for the different continents and hemispheres and for the whole world, and give a general idea of the changes taking place during the periods under consideration in the area under each crop, quantities harvested and the commercial movement in each product.

The part devoted to prices contains the weekly quotations of 25 agricultural products on the principal world markets for the year 1913 and for the period January, 1926, to June, 1930. In the freights section will be found the quotations for the carriage of wheat, maize and rice on the most important shipping routes, and in the section reserved for fertilizers and chemical products useful in agriculture are published statistics of production, trade and prices for 15 products. In the rates of exchange section are set out the rates on the New York exchange for the most important currencies.

For the first time there have been introduced into the volume special chapters on the importance and distribution of the agricultural population, and the distribution of agricultural holdings according to their size and mode of tenure and forestry.

Copies of the latest volume may be purchased from the Ministry (price 25s.).

* * * * * *

The Agricultural Index Number

PRICES of agricultural produce during November were on average 29 per cent. higher than in the corresponding month of the base years 1911-13 and the same as a month earlier, but 15 points below the level recorded in November, 1929. During the period under review the index figure for most descriptions of produce showed a decrease, but these reductions were counterbalanced by increases in fat pigs, potatoes and milk.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	37
May	57	50	42	54	44	34
June	53	48	41	53	40	31
July	49	48	42	45	41	34
August	54	49	42	44	52	35
September	55	55	43	44	52	42
October	53	48	40	39	42	29
November	54	48	37	41	44	29
December	54	46	38	40	43	—

Grain.—Quotations for both wheat and oats declined by 3d. per cwt. and the index numbers were lower by 4 and 5 points respectively at 11 and 17 per cent. below pre-war levels. In the case of barley, a fall of 2d. per cwt. was recorded, and the index figure was reduced by 2 points to 11 per cent. above 1911-13. As compared with a year ago, wheat was cheaper by 2s. 8d. per cwt. and oats by 1s. 7d., but the average for barley was unchanged.

Live Stock.—Values for fat cattle receded further in November, and the average showed a drop of fully 1s. per live cwt., the index number being 3 points lower on the month at 28 per cent. above pre-war. Fat sheep also sold at rather easier prices, and the index figure declined by 9 points to 53 per cent. in excess of the base years. Bacon pigs showed a slight recovery from the level ruling in October, and the index figure appreciated by 4 points to 29 per cent. above 1911-13, while quotations for porkers advanced further, the index number being 5 points higher at 50 per cent. in excess of pre-war. As compared with November, 1929, bacon pigs were about 2s. 8d. and porkers 2s. 3d. per score cheaper. Values for dairy cows were about 10s. per head higher than in October, and averaged 31 per cent. more than in the base years. Store cattle, however, sold at rather lower prices, and the index figure fell by 4 points to 23 per cent. above 1911-13. Although a rise of close on 2s. 6d. per head was recorded for store sheep, this increase was proportionately less than that which occurred between October and November of the base years, with the result that the index number showed a drop of 6 points to 56 per cent. in excess of pre-war. In the case of store pigs, however, the fall in price during the month under review was not so severe as that recorded in the corresponding period of 1911-13 and the index figure was 4 points higher at 111 per cent. over pre-war.

Dairy and Poultry Produce.—In most districts, the contract price of milk during November was much the same as that ruling in October, but in the Manchester area a considerable seasonal rise was recorded, causing the index figure to advance by 10 points to 57 per cent. above pre-war. Butter prices were about unchanged, but the index number was 4 points lower. Cheese, on the other hand, was slightly dearer, but as the increase was proportionately less than in the corresponding period of 1911-13, the index fell by 1 point to 16 per cent. above pre-war. Values for eggs continued to rise, but for the same reason as in the case of cheese the index

number was 23 points lower at 33 per cent. above pre-war. At the corresponding period a year ago, the index for eggs fell by 27 points to 54 per cent. over 1911-13. Poultry was a little cheaper at 36 per cent. more than pre-war.

Other Commodities.—Potato prices were about 2s. 6d. per ton higher in November than in October, and the index number rose by 6 points to 46 per cent. above the level of the base years, which compares with a figure of only 18 per cent. in November, 1929. Quotations for hay continued to decline, the reductions during November amounting to about 3s. 6d. per ton and the index number was reduced by a further 3 points to 7 per cent. below the pre-war level; a year earlier there was a rise of 1 point to 41 per cent. above pre-war. Apples were rather dearer at an average of 34 per cent. above 1911-13, but the general index for vegetables showed little change, increases in cauliflowers and celery being counter-balanced by reductions in most other descriptions. Wool prices were again lower on the month and the index figure fell by 5 points to 17 per cent. below pre-war.

Index numbers of different commodities during recent months and in November, 1928 and 1929, are shown below :—

Percentage increase as compared with the average prices ruling in the corresponding months of 1911-13.

Commodity	1928	1929	1930			
	Nov.	Nov.	Aug.	Sept.	Oct.	Nov.
Wheat	31	24	4	—3*	—7*	—11*
Barley	25	11	—12*	3	13	11
Oats	27	6	—13*	—12*	—12*	—17*
Fat cattle	31	33	37	35	31	28
,, sheep	53	53	62	62	62	53
Bacon pigs	24	56	41	33	25	29
Pork ,,	33	70	50	44	45	50
Dairy cows	38	33	35	31	30	31
Store cattle	20	15	30	27	27	23
Store sheep	53	51	66	69	62	56
Store pigs	31	108	112	107	107	111
Eggs	51	54	40	36	56	33
Poultry	47	43	43	40	39	36
Milk	71	67	58	100	47	57
Butter	52	50	33	24	14	10
Cheese	78	32	28	22	17	16
Potatoes	53	18	25	51	40	46
Hay	4	41	15	11	—4*	—7*
Wool	66	41	—5*	—8*	—12*	—17*

* Decrease.

Export of Breeding Stock

NUMBER and declared value of animals, living, for breeding, exported from Great Britain and Northern Ireland during the three months ended September, 1930, compared with the corresponding period of 1929. (From returns supplied by H.M. Customs and Excise.)

Country to which exported	July to Sept., 1930		July to Sept., 1929	
	Number	Declared value	Number	Declared value
		£		£
CATTLE				
Argentina	33	4,716	22	3,550
Belgium	145	3,380	0	0
Brazil	1	100	12	969
Chile	1	1,050	1	945
United States of America	29	2,441	0	0
Uruguay	14	3,445	13	3,500
Australia	0	0	15	3,118
Canada	1	80	175	15,351
Irish Free State	409	8,808	531	11,827
Southern Rhodesia	0	0	28	1,857
Union of South Africa	11	921	2	85
Other countries	24	1,505	30	1,131
Total	668	26,446	829	42,333
SHEEP AND LAMBS				
Argentina	203	3,500	166	4,140
Brazil	10	150	50	1,583
Chile	5	101	59	2,745
France	39	543	147	1,500
United States of America	69	1,127	8	507
Uruguay	162	3,174	78	2,361
Australia	12	333	80	2,214
Canada	37	367	264	2,448
Irish Free State	199	1,081	309	958
Other countries	34	629	28	478
Total	770	11,005	1,189	18,934
SWINE				
Argentina	0	0	21	280
Denmark	12	270	18	354
Greece	6	175	1	11
Hungary	0	0	37	783
Japan	16	442	0	0
Poland	2	84	19	329
Australia	5	180	13	564
Canada	0	0	21	325
Irish Free State	127	2,139	102	645
Other countries	35	652	21	524
Total	203	3,942	253	3,815

Railway Freight Rebate Scheme

UNDER the Local Government Act, 1929, the railway companies were relieved of a proportion of their local rates on the condition that the sums thus saved were used in giving rebates from the carriage charges on certain selected traffics.

These traffics included most of the fertilizers and feeding stuffs in common use, milk, potatoes, and livestock, and one-fifth of the net fund available for rebates was allocated to these agricultural traffics.

During the first year of the operation of this permanent scheme, the rebate allowed on all these traffics was 10 per cent. of the railway freight charge, but at the annual review held in November last, the Railway Rates Tribunal found it possible to increase the rebate for the current year to 12½ per cent. The selected agricultural traffics, when sent by goods train (or, in the case of milk, by passenger train) are, therefore, now subject, as from December 1, 1930, to a freight rebate of 12½ per cent.

* * * * * *

Eriksson Prizes

IN connexion with the International Conference on Phytopathology and Economic Entomology held in Holland in 1923 prizes were offered in 1928 for the two best memoirs concerning (1) Investigations on Rust Diseases (Uredineæ) of Cereals, and (2) Investigations on the Role played by Insects or other Invertebrates in the Transmission or Initiation of Virus Diseases in Plants, the prizes being of the value of 1,000 Swedish crowns (about £55) each. It is now announced that the prize for the most meritorious investigations on Rusts has been awarded to Mr. J. H. Craigie, Senior Plant Pathologist in Charge, Dominion Rust Research Laboratory, Winnipeg, Manitoba, Canada. Mycologists will recollect that it was Mr. Craigie who recently discovered the hitherto unknown and important function of the spermogonia of the Rust fungi. The adjudicators have made no award in connexion with the subject for the second prize.

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Farm Workers' Minimum Wages.—Meetings of the Agricultural Wages Board were held on November 18 and December 16, at 7 Whitehall Place, London, S.W. 1.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages and proceeded to make the following Orders carrying these decisions into effect.

Berkshire.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over are 30s. per week of 41 hours in the weeks in which Christmas Day and Good Friday fall and 50 hours in any other week, with overtime at 8½d. per hour. In the case of female workers of 19 years of age and over the minimum rate is 5d. per hour for all time worked.

Cornwall.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over are 32s. per week of 33 hours in the week in which Christmas Day and Boxing Day fall, 42 hours in the weeks in which Good Friday and Whit Monday fall and 51 hours in any other week, with overtime at 9d. per hour on weekdays and 10d. per hour on Sundays. In the case of female workers of 20 years of age and over the minimum rate is 5d. per hour for all time worked.

Derbyshire.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 26, 1930, until December 25, 1931. The minimum rate in the case of male workers of 21 years of age and over is 8d. per hour for a week of 54 hours with overtime at 10d. per hour for Sunday work. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour on weekdays with overtime at 8d. per hour for employment on Sunday.

Hampshire and Isle of Wight.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over is 30s. 6d. per week of 40½ hours in the week in which Christmas Day falls and 48 hours in any other week in winter; 41½ hours in the week in which Good Friday falls and 51 hours in any other week in summer. The Order provides that in the case of a worker who is given a clear day's holiday in the week following that in which Good Friday falls the number of hours in respect of which the minimum weekly wage is payable shall be 51 in the week in which Good Friday falls and 41½ in the following week. The overtime rate in the case of male workers of 21 years of age and over is 8d. per hour except in the case of the employment of carters, cowmen, shepherds or milkers on work in connection with the immediate care of animals when the overtime rate is 7½d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for all time worked.

Norfolk.—(1) An Order to come into operation on December 28, 1930, when the existing rates are due to expire, and continuing in force until December 26, 1931. The minimum rates in the case of male workers of 21 years of age and over are 30s. per week of 42 hours in the week in which Good Friday falls and 50 hours in any other week in summer, 40 hours in the week in which Christmas Day falls and 48 hours in any other week in winter, with, in addition, in

the case of teamsmen, cowmen, shepherds and yardmen, 5s. 6d. per week, and in the case of sheep tenders and bullock tenders 4s. 6d. per week to cover employment in excess of those hours on duties in connexion with the immediate care of animals except on Good Friday and Christmas Day. In respect of work in connexion with the immediate care of animals on Good Friday and Christmas Day an additional sum of 5s. is payable in regard to each of those days except in any case in which a clear day's holiday on full pay is given either in the week in which those holidays fall or in the following week. The overtime rates in the case of all classes of male workers of 21 years of age and over are 9d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6½d. per hour on weekdays and 7½d. per hour on Sundays.

(2) An Order fixing special minimum and overtime rates of wages for male workers employed on the corn harvest in 1931. In the case of workers of 21 years of age and over employed throughout the harvest the wage payable in respect of the harvest is an inclusive sum of £11. In the case of workers who are not employed for the full harvest period special differential rates have been fixed for overtime employment on the corn harvest, the rate in the case of workers of 21 years of age and over being 9½d. per hour.

Somerset.—An Order continuing the operation of the existing minimum and overtime rates from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over are 32s. per week of 32½ hours in the week in which Christmas Day and Boxing Day fall, and 50 hours in any other week in winter; 42¾ hours in the weeks in which Good Friday, Easter Monday and Whit Monday fall, and 52 hours in any other week in summer. Provision is made for the modification of the hours of work in certain weeks where holidays are given in lieu of any of the public holidays mentioned. The overtime rate in the case of male workers of 21 years of age and over is 9d. per hour except for employment on the hay and corn harvests when the rate is 10d. per hour. In the case of female workers of 21 years of age and over the minimum rate is 6d. per hour for all time worked.

Surrey.—An Order continuing the operation of the existing minimum and overtime rates from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over are: horsemen, stockmen or shepherds 38s. 8d. per week of 51 hours in the weeks in which Christmas Day and Good Friday fall and 60 hours in any other week; other male workers (except casual workers) 32s. 3d. per week of 41 hours in the weeks in which Christmas Day and Good Friday fall and 50 hours in any other week; casual workers, 7¾d. per hour. Provision is made for the payment of the minimum weekly wage except in the case of casual workers in respect of a reduced number of hours in Easter week instead of in the week in which Good Friday falls if a holiday is given on Easter Monday in lieu of a holiday on Good Friday. The overtime rates in respect of all classes of male workers of 21 years of age and over are 10d. per hour on weekdays and 11½d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is

5½d. per hour with overtime at 7d. per hour on weekdays and 8d. per hour on Sundays.

Wiltshire.—An Order continuing the operation of the existing minimum and overtime rates of wages from December 21, 1930, until December 19, 1931. The minimum rates in the case of male workers of 21 years of age and over are 30s. per week of 39½ hours in the week in which Christmas Day falls, 48 hours in any other week in winter, 41 hours during the week in which Good Friday falls and 50 hours in any other week in summer, with overtime at 8d. per hour except for overtime employment on harvest work in the hay and corn harvests when the rate is 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for all time worked.

East Riding of Yorkshire.—An Order to come into operation on November 24, 1930 (*i.e.*, the day following that on which the present rates are due to expire), and to continue in force until November 23, 1931. The rates in the case of male workers engaged by the year and boarded and lodged by their employer are: foremen, £81 12s. 0d.; beastmen and shepherds, £73 19s, 0d.; waggoners, £71 8s. 0d., with lesser rates for lads and beginners. These rates are payable in respect of a year consisting of 51 weeks of the following number of hours; in the week in which Good Friday falls 43, in any other week in summer 52½, in the week in which Christmas Day falls 39½ and in any other week in winter 48, with, in addition, in each case, not more than 12 hours per week on weekdays and 3 hours on Sundays spent on work in connexion with the care of and attention to stock. In the case of other male workers boarded and lodged by their employer the minimum rates per week are: foremen, 32s.; beastmen and shepherds, 29s.; waggoners, 28s., with lesser rates for lads and beginners, these rates being payable in respect of the same number of hours per week as in the case of workers engaged by the year. The minimum rate for male workers of 21 years and over who are not boarded and lodged by their employer is 35s. (instead of 36s. as at present) per week of 48 hours in winter and 52½ hours in summer, except that in the week in which Christmas Day falls the hours for which the minimum wage is payable are 39½, and that in the week in which Good Friday falls the hours are 43. The overtime rates for all classes of male workers of 21 years of age and over are 10d. per hour on weekdays and 1s. per hour on Sundays, Good Friday and Christmas Day. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 9d. per hour.

North Riding of Yorkshire.—An Order cancelling as from November 23, 1930, the existing minimum and overtime rates and fixing fresh rates as from November 24, 1930, to continue in force until further notice. The minimum rate in the case of male workers of 21 years of age and over is 33s. (instead of 34s. as at present) per week of 48 hours in winter and 52½ hours in summer with, in addition, payment at 3d. per hour in the case of workers who are boarded and lodged by the employer and 6d. per hour for workers who are not so boarded and lodged in respect of employment in excess of those hours in the care of and attendance upon animals. The minimum rate for male casual workers of 18 years of age and over is 6d. per hour for all time worked. The overtime rates of wages for male workers of 21 years of age and over, other than casual workers, are 10d. per hour on weekdays and 1s. per hour

on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour for a week of 44 hours with overtime at 9d. per hour.

Radnor and Brecon.—An Order varying the minimum and overtime rates of wages as from January 1, 1931. The minimum rate in the case of male workers of 21 years of age and over is 31s. per week of 54 hours in summer and 50 hours in winter (instead of 48 hours in winter as at present) with overtime at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 6¼d. per hour on weekdays and 7½d. per hour on Sundays. These rates will continue in operation until April 30, 1931.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Enforcement of Minimum Rates of Wages.—During the month ending December 13 legal proceedings were instituted against 14 employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows:—

County	Court	Fines			Costs			Arrears of wages			No. of workers involved
		£	s.	d.	£	s.	d.	£	s.	d.	
Gloucester	Cheltenham	8	0	0	3	13	6	50	19	3	3
,,	,,	2	0	0	2	4	6	11	6	0	1
,,	Stroud	20	0	0	0	16	0	49	5	3	2
Lancaster	Chorley	1	0	0	2	2	0	26	10	0	4
Worcester	Shipston-on-Stour	8	0	0	2	7	0	36	8	2	2
Yorks, N.R.	Flaxton		*			—			—		1
Yorks, W.R.	Rotherham	4	0	0	1	1	0	26	10	0	1
,,	,,	10	0	0	2	2	0	54	0	0	2
,,	,,		†		0	8	0	10	0	0	1
,,	,,	3	0	0	0	7	6	24	7	3	2
,,	,,	1	0	0	1	1	0	12	10	0	1
,,	Sheffield	8	0	0		—		40	0	0	2
Carmarthen	Carmarthen	1	0	0		—		10	10	0	1
Flint	Holywell		†		0	4	6	21	0	0	1
		£66	0	0	£16	7	0	£373	5	11	24

* Case dismissed.
† Dismissed under Probation of Offenders Act.

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Foot-and-Mouth Disease.—No further outbreaks have occurred in Great Britain since the confirmation of the outbreak at Lockwood, Huddersfield, Yorks (West Riding), on November 10—referred to in the November issue of this JOURNAL. The restrictions imposed in consequence of that outbreak were withdrawn on December 2. The position, as this issue goes on to press, is that as from the latter date no general movement restrictions have been in force in connexion with foot-and-mouth disease in any part of Great Britain.

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS: ENGLAND

Cambridgeshire: Mr. G. W. Channon, N.D.A., N.D.D., B.D.F.D., and Mr. J. R. Scott, B.Sc., have been appointed Assistant Agricultural Instructors.

Mr. K. V. Cramp,* R.H.S. Diploma, has been appointed Assistant Horticultural Instructor.

Somerset: Mr. R. A. Engledow has been appointed Instructor in Gardening and Head Gardener, *vice* Mr. K. V. Cramp, R.H.S. Diploma.

Mr. F. R. Wallburton has been appointed Assistant Instructor in Poultry Keeping, *vice* Mr. H. F. Burdett.

Mr. W. S. Turner has been appointed Manager of the County Egg-Laying Trials, *vice* Mr. J. F. Siderfin.

Yorkshire (Agricultural Department, University of Leeds): Miss M. J. Carter, B.Sc., N.D.P., and Miss J. McL. Millar, N.D.D., have been appointed Assistant Lecturers in Poultry Husbandry.

Miss E. G. Steward, N.D.P., Assistant Lecturer in Poultry Husbandry, has left the service of the Authority.

* *Wholly employed by the County Council, but only partially on agricultural education work.*

WALES

Glamorganshire: Mr. Frederick Blakemore has been appointed Instructor in Veterinary Science.

Mr. E. Ll. Harry has been appointed Instructor in Agricultural Economics.

Mr. William Williams has been appointed Instructor in Agriculture.

Mr. H. R. Jenkins has been appointed Instructor in Small Live Stock.

The above are new posts under the Extension Scheme.

Mr. William Evans (Poultry Instructor for Carmarthenshire) has been appointed Instructor in Poultry Husbandry *vice* Mr. G. E. Reddaway, who has resigned.

Montgomeryshire: Mr. Oswald Bowen has been appointed Instructor in Poultry Keeping.

This is a new appointment under the Extension Scheme.

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NOTICES OF BOOKS

Manual of Bacterial Plant Pathogens. By Charlotte Elliott. (London: Baillière, Tindall & Cox. Pp. ix + 349. Price 22s. 6d. net.)

When one visits certain of the scientific establishments in the United States of America, one is struck with the ubiquity and utility of the roll top desk, the expanding book case, and the card index cabinet. Out of one of the last-named, the present volume has emerged. It constitutes a kind of detailed "Who's Who" concerning the various bacterial parasites of plants and their associated non-pathogenic forms. The first part of the book, covering over 250 pages, contains a list of bacterial plant pathogens, arranged according to genera in alphabetical order, whilst the non-pathogenic organisms associated with plant diseases follow in a similar section, comprising some 40 pages or so. In a third section the organisms are arranged in the form of a chronological chart, covering some 10 pages. In this are to be

found details such as the date on which the organism was named, its host, its size, its thermal deathpoint and its response to several characteristic, differentiating tests.

Finally, there is an index which includes the names of the host plants and of the bacteria dealt with in the text. In one respect the index is perhaps not so satisfactory as the rest of the book. With those hosts, as well as with those parasites, that are mentioned frequently in the text, one is provided solely with a series of numbers, referring to pages, without any further clue as to what particular aspect of host or parasite is dealt with on any given page. Under Potato, for instance, there are no fewer than 66 page entries; under *Bacillus carotovorus* there are no fewer than 63. It would have meant a little more labour, in such cases, to have indicated very briefly the type of information concerning host or parasite to be found on each page, but it would have been a great help to the user of the book. Even to have indicated, by a change in type-fount, the particular page on which the main section dealing with a given organism began, would have been a considerable advantage.

The succinct information supplied concerning each organism in the alphabetical lists appears to be ample, and the literature lists, which are arranged in chronological order, appear to be practically exhaustive and, on the whole, up to date, some of the references, indeed, being to work published in 1930, the year in which the book itself was published. A random test, however, suggests that absolute perfection in this respect has not been attained; and it is, of course, scarcely to be expected. Thus, looking up, by chance, Paine's *Pseudomonas solaniolens* in the index (in the specific name of which there happens to be a misprint!) one finds on the appropriate page the principal literature references to what has hitherto been published in connexion with "Spraing" of potatoes. Although, however, the latest entry is dated 1930, there is a paper by Burr in 1928 and one by Fruwirth in 1929 that are not included. Possibly similar slight omissions might be found in other instances, but, if so, they need not be looked upon as seriously minimizing the value of the book. Plant pathologists, especially those who are particularly interested in bacterial diseases, will welcome this detailed directory of their organisms, and will find the volume a tool calculated to save them much time and labour in securing information on the organisms themselves and on the original sources from which it has been derived. It should certainly be amongst the books on their shelves.

Practical Poultry Management. By J. E. Rice, B.S., and H. E. Botsford, B.S. Second edition. Illustrated. Pp. xvii + 540. (New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. 1930. Price 13s. 6d. net.)

The rapid expansion of the poultry industry during recent years has produced an extensive and many-sided literature of the subject, especially in the United States of America, where the output of specialist publications has assumed large proportions. Directly or otherwise, so many branches of science have a bearing on poultry-keeping, and so numerous are the problems confronting the modern poultry-keeper, that it has become practically impossible to deal adequately with the subject as a whole in a single volume. While the present work cannot claim to be a comprehensive and detailed treatise on poultry in general, it deals in a concise and readable manner with the main facts, principles and natural laws underlying their successful management. The chapters devoted to culling, incubation, selection, housing, feeding, exhibiting and judging, although primarily applicable to American conditions,

will repay study by the British poultry-keeper, while the information regarding the anatomy and physiology of the domestic fowl, and diagnosis and treatment of disease, is sound and simply phrased, as well as eminently practical. Despite its transatlantic flavour, this is a book that should prove useful to British poultry-keepers who wish to bring their practice up to date.

The Agricultural Crisis and the Way Out. By C. Brereton, M.A., L. ès L., D. ès Lettres. With Preface by Lord Ernle, P.C., M.V.O. Pp. 47. (Norwich: Jarrold and Sons, Ltd., London Street. Price 3d.)

This is a reprint of articles by a well-known landowner which appeared recently in the *Eastern Daily Press*, their object being "to set before the general public in as dispassionate a way as possible the desperate plight of arable farming and fruit-growing, and especially to bring home to the urban population the parlous state of a great industry with whose fortunes their own are intimately bound up." The causes which have brought about the present situation are analysed, and the proposed remedies and palliatives reviewed. The author stresses the urgency of the problem. His proposals include a guaranteed price for wheat, a duty on foreign malting barley, control by licence or otherwise of foreign imports combined with voluntary rationing of the amount of home production and the extension of marketing schemes.

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Grass Land

Notes on Intensive Cultivation of Grassland. *W. Low.* (Trans. Highl. Agric. Soc. Scot., xlii, 1930, pp. 113-117.) [63.33-16; 63.33.]

High Protein Pasture. *F. T. Shutt.* (Chem. and Ind. (Jour. Soc. Chem. Ind.), 49, 33 (August 15, 1930), pp. 679-681.) [63.33-16; 63.33; 63.60433.]

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The Effect of Pigs upon Grassland. *V. C. Fishwick.* (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 180-181.) [63.33; 63.64.]

Horticulture

The Effect of Certain Treatments on the Germination of Tomato Seeds. *Mary Jozefowicz.* (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 504-513.) [63.1951; 63.513.]

Some Observations on Tomato Plants from Seed submitted to High Temperatures. *Mary Jozefowicz.* (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 514-521.) [63.1951; 63.513.]

The Root System of Fruit Tree Seedlings. *V. A. Kolesnikov.* (Jour. Pom. and Hort. Sci., viii, 3 (Aug., 1930), pp. 197-203.) [63.41.]

The Dying Off of Rootlets of Fruit Trees. *V. A. Kolesnikov.* (Jour. Pom. and Hort. Sci., viii, 3 (Aug., 1930), pp. 204-209.) [63.41.]

Rootstock and Scion Relationship. Some Effects of Scion Variety upon the Rootstock. *T. Swarbrick.* (Jour. Pom. and Hort. Sci., viii, 3 (Aug., 1930), pp. 210-228.) [63.41.]

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The Winter Shoots of Apple Trees. Their Use in the Identification of Varieties. *R. T. Pearl.* (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 74-86.) [63.41.]

The Nutrition of Fruit Trees. I.—Some Effects of Deficiencies of Essential Elements on Fruit Trees. *T. Wallace.* II.—Response of Apple Trees on Known Rootstocks to Applications of a Complete Fertilizer. *J. Amos, R. G. Hatton* and *T. N. Hoblyn.* III.—The Reaction to Potash Fertilizers of Apple Trees in the Field. *N. H. Grubb.* IV.—Some Observations upon the Growth and Seasonal Cycle of Food Reserves in Apple Trees. *T. Swarbrick* (from the Proceedings of the Association of Economic Biologists, II., March 21, 1930). (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 649-686.) [63.41 ; 63.41-16.]

The Study of Pollination in Relation to Cherry Orchards. *C. H. Hooper.* (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 202-204.) [63.41-08 ; 63.41.]

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The Physiology of Virus Diseases in Plants. I.—The Movement of Mosaic in the Tomato Plant. *J. Caldwell.* (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 429-443.) [63.23.]

The Role of *Thrips tabaci* Lindeman in the Transmission of Virus Diseases of Tomato. *Phyllis H. Jarrett.* (Ann. App. Biol., xvii, 3 (Aug., 1930), pp. 444-451.) [63.23 ; 63.27 ; 63.512.]

A Study of the Degeneration of Certain Potato Stocks. *T. Whitehead.* (Ann. App. Biol. xvii, 3 (Aug., 1930), pp. 452-486.) [63.23 ; 63.512.]

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The Control of Apple Scab. I.—Bramley's Seedling and Newton Wonder. *N. B. Bagenal, W. Goodwin, E. S. Salmon* and *W. M. Ware.* II.—Allington Pippin and Newton Wonder. *W. Goodwin, E. S. Salmon* and *W. M. Ware.* (Jour. S.E. Agric. Coll., Wye, No. 27 (1930), pp. 186-201.) [63.24.]

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Potatoes in Stock Feeding. *J. K. Thompson.* (Trans. Highl. Agric. Soc. Scot., xlii, 1930, pp. 128-151.) [63.60432.]

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"Grass-Disease." *S. H. Gaiger.* (Jour. Yorks. Agric. Soc., 1930, pp. 29-38.) [619.1.]

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NOTES FOR THE MONTH

World's Grain Exhibition and Conference

DEVELOPMENTS in the wheat markets of the world in recent weeks have turned attention particularly toward the World's Grain Exhibition and Conference which is to be held at Regina, Saskatchewan, in 1932. Original plans were largely for an exhibition of the chief food cereals, but existing conditions have turned the spot-light more particularly upon the Conference phase of the event. Experts in agricultural economics and agriculture from all parts of the world will be gathered together for a serious survey of conditions affecting grain production and of the best means of securing uninterrupted prosperity for those who are dependent upon that industry. The Exhibition, which is the largest of its kind ever planned, with prize money totalling more than £40,000, will still be a feature of great interest.

The Chairman of the National Committee is the Hon. Robert Weir, Minister of Agriculture in the Canadian Government, and each of the Canadian provinces has its provincial committee under the Chairmanship of the Provincial Minister of Agriculture. Representatives of these committees, along with a special committee on publicity, have recently completed their autumn conference.

Provision for the accommodation of the great numbers who are expected to attend the Conference in Regina in 1932 is receiving attention. It has been decided to ask the city of Regina to set aside fifty acres for a special camp that will be run on approved lines and will afford every facility for visitors. The co-operation of the Royal Canadian Mounted Police will be an important factor in this connexion. Standard charges will be authorized and the rates in hotels will be fixed.

A committee composed of technical experts is considering the many questions relative to the judging of the competitive

classes. There is a prospect that an international board of judges will be established. Not only will the judging be based upon the threshed cereals, but the cereals will be planted in test plots of land provided at the Dominion Government Experimental Farm at Indian Head, Saskatchewan, so that they may be judged while in the process of growing.

The co-operation of the Canadian Federal Department of Trade and Commerce has been secured, with the result that the services of Mr. J. O. Turcotte, Canadian Exhibition Commissioner, whose work at the World's Poultry Congress in London and at the Exhibition at Antwerp has received much favourable notice, will be in charge of the decorating and the staging of exhibits. It is expected that the number of exhibits will run to many thousands.

* * * * * *

Short Course for Poultrymen in Hampshire

FOLLOWING the success of a three-day course for cowmen held in September last—a note of which appeared in the December issue of this JOURNAL—a course of a similar length was arranged for men and women engaged in the poultry industry at the Farm Institute, Sparsholt, from December 31, 1930, to January 3, 1931.

Particulars of the course, including a syllabus and time table, were circulated to a number of poultry farmers in Hampshire early in December; no difficulty was experienced in obtaining entrants, and the number accepted was limited to 15, which was believed to be the maximum with whom the demonstrations could be effectively carried out.

The course was held in bad weather, and, from many points of view, at an inconvenient time of the year. It was, however, necessary that it should take place during the vacation, and desirable to choose a time that is comparatively slack on the average poultry farm in order that the employees might be spared to attend.

The following summary indicates the ground covered by the lectures and demonstrations which were given by members of the county staff with the assistance of officers of the Ministry :—

Lectures

Breeding, 3 hours.
Food Stuffs and Feeding, 3 hours.
Incubation and Rearing, 2 hours.
Fattening, 1 hour.
Housing and Layout of Plant, 1 hour.
Diseases and their control, 2 hours.

Demonstrations

Drawing and Trussing, 1 hour.
Methods of making a Post-Mortem Examination, 1 hour.
Culling and Selection by Handling, 3 hours.
Taking Blood for Agglutination Test and Vaccinating against Fowl Pox, 1 hour.

An equally valuable part of the course consisted of an hour's discussion each evening, during which a free interchange of ideas took place, on such problems as marketing, maturity and its relation to egg size, and other subjects, which lack of time prevented from being included in the syllabus.

All who attended were shown something of the activities in other departments of the Institute.

Three technical points of interest arose :—

(1) That more time could be profitably devoted to practice in the selection and culling of stock by handling.

(2) That there was a general desire for more information on diseases.

(3) That the economy of increased feeding in order to maintain high egg-production is not appreciated by many poultrymen, and should be further emphasized.

In the opinion of those who took it, the course was a great success and will be of considerable direct benefit to them in their work. There is, therefore, every encouragement to continue the series and arrange further courses for cowmen, poultrymen, and perhaps other skilled agricultural workers during future vacations, and every probability that the indirect effect of those already held will be to increase the demand for more. The period of three days appears to be short enough to allow of men being spared, and long enough for a good many ideas to be assimilated under such conditions as obtain at a Farm Institute.

* * * * * *

Home-Grown Feeding Stuffs

WHEN he was an Assistant Secretary of this Department 26 years ago (1904), Dr. (now Sir William) Somerville expressed the following view: "I am by no means sure that it is in the best interests of agriculture that farmers should buy imported foods largely. In my opinion it is economically a much sounder policy to show farmers how they can grow larger and more nutritious crops at home. These demonstrations, aided by the Board, which show farmers how the crop on one half of a field can, *unaided by imported food*, produce more meat than the crop on the

other half given to animals *along with large quantities of cake*, are in my humble judgment more worthy of attention than fresh sources of cake and the like."

Since that time, research has confirmed the idea underlying Sir William Somerville's opinion. It is now recognized that in the past too much emphasis was laid upon protein-feeding (or cake-feeding) of animals on well-grazed pastures, and it is probably true that there is still in many cases an excessive use, and therefore waste, of protein in the feeding of stock at all times of the year. Judicious balancing of rations in accordance with the latest information gained by research may well lead to economies in the cost of production. The Ministry recently invited Dr. H. E. Woodman to prepare a Bulletin indicating how feeding stuffs produced on the farm may be most advantageously used in the feeding of stock for the production of meat, milk and wool. The Bulletin has now been issued, and may be obtained from the Ministry at the price of 8*d*. post free.

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The Part of Spraying in High-grade Fruit Production

OF the home-grown apples and pears, sold in the markets at Christmas time, some were so perfect in quality, and of such pleasing appearance, that even the greatest critics of English fruit must have been surprised and almost satisfied. The small packages of rosy Cox's Orange Pippin apples, each carefully wrapped in a paper doily, and of juicy Doyenné du Comice pears embedded in their nests of wood wool, were as near perfection as can be. Such fine fruits indicate that, with energy and will, the British grower can excel in supplying the market with dessert fruit of a much higher standard of quality, and packed in a more attractive way, than can be brought from overseas. Such fruit, however, came from orchards where fruit growing is conducted on modern lines, and where the packing was done by people who have been prepared to forsake the accepted methods of the past and to use others that helped the fruit to make its appeal. These few men, by their example, are helping to establish in England the modern methods by which the production of this high-class market fruit is made possible.

These modern methods are not wrapped in mystery, but are simply the adaptation of science to fruit growing in the orchards, and the application of business methods in organization and in marketing.

Tree nutrition, fruit thinning and spraying all play their part, but it is more timely now to emphasize the last-named subject, since the importance of spraying cannot be stressed too strongly. Spraying is fundamental for the production of high-grade fruit; the only debatable point centres round the sprays to be used, and these will vary with climate.

In England the fruit plantations should be sprayed during the autumn and winter months with a reliable tar distillate wash (see article at p. 1078), either alone or combined with a mineral oil. This wash—the cleanser of trees and killer of insects' eggs—does so much in controlling insects and in improving the vitality of the trees that no fruit grower can afford not to use it. The tar-oil washes have little or no fungicidal action, and so cannot be expected to keep apples and pears free from scab, or plums from brown rot. For this reason, therefore, when the trees are nearing blossom time, and again when the petals have strewed the ground, the sprayers must be set at work forcing lime and sulphur or Bordeaux mixture on to the leaves to keep the fungus spores from gaining an entrance. Man's part is to keep the tree healthy, and there will follow the clean fruit that the market needs and for which good prices are paid.*

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Agricultural Statistics, 1929 (Part II)

THE Ministry's Report on the prices and supplies of agricultural produce in 1929-30 has recently been published. In the opening part of the report, a general indication is given by means of index numbers of the changes that have taken place in recent years up to the late spring of 1930 in the price-level of agricultural produce as a whole, and of the alterations in prices of the different kinds of produce. In addition, the price changes which have occurred in live-stock farming are contrasted with those in arable farming, market gardening and fruit farming. References are also made to the more important

* Information on fruit growing, spraying of fruit trees, and insect and fungus pests of fruit will be found in the following publications which may be obtained from the Ministry at the prices named, post free:—

Fruit Production: Tree Fruits, 1*s*. 6*d*. net.
Fruit Production: Soft Fruits and Nuts, 1*s*. net.
Insect Pests of Fruit Trees, 10*d*. net.
Fungus Diseases of Fruit Trees, 8*d*. net.
Commercial Fruit Tree Spraying and What it Costs, 6*d*. net.

Every fruit grower should possess these publications and make the fullest use of them.

alterations in prices of feeding stuffs and fertilizers over the same period, to agricultural wages, prices of seeds, and to the progress recorded in 1929 in the administration of the Markets and Fairs (Weighing of Cattle) Acts, 1887 to 1926.

The remainder of the report is devoted, for the most part, to a consideration of the position as regards each of the more important individual commodities from the point of view of price changes, and of alterations in total imports and in the quantities received from the different sources, while the report concludes with a brief summary of the principal variations, in 1929, in the sources of imported supplies.

The usual statistical tables are appended showing average prices and imports in 1929 of a large number of agricultural products, with, in many cases, comparative figures for earlier years.

Copies of the Report, which forms Part II of the Agricultural Statistics, 1929, may be purchased through any bookseller or direct from H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2, price 1*s*. net or 1*s*. 2*d*. post free.

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Production of Home-Grown Beet-Sugar

ACCORDING to returns made to the Ministry by the beet-sugar factories operating in Great Britain, the total quantity of home-grown beet-sugar manufactured during December, 1930, together with the quantity produced during the corresponding month in 1929, was :—

	cwt.
December, 1930	2,261,698
December, 1929	1,815,675

The total quantities of sugar produced during the two manufacturing campaigns to the end of December were :—

	cwt.
1930-31	6,990,578
1929-30	5,335,153

* * * * * *

Johne's Disease in Cattle

IN recent years Johne's disease has been a matter of growing concern to the veterinary profession, and to farmers whose cattle have suffered from it. This disease is a chronic, contagious enteritis that affects bovine animals. Although animals of other species—sheep, deer, goats and (rarely) horses—may be attacked, the disease is essentially one of cattle, and in its clinical form is seldom

observed in animals under 18 months of age. There is no reason to believe that any particular breed of cattle in Great Britain is more vulnerable to the disease than others are. Johne's disease is not transmissible to man, and both poultry and swine are naturally immune from it. The condition, which is also known as bacterial enteritis, or paratuberculosis, has been found to exist in many parts of the world. In order to provide information and guidance for those who may require it, the Ministry has just published a short, illustrated Bulletin on the subject, and copies may now be obtained at the price of 3*d*. net, post free.

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Agricultural Instruction in Essex

No fewer than 127 students are receiving regular and organized instruction in agricultural subjects in Essex at the present time. Of these, 28 are enrolled for the correspondence course in Farm Book-keeping which is being conducted by the Economics Branch of the School of Agriculture at Cambridge. This course affords a training in the keeping of farm accounts and in the estimation of the contents of stacks, clamps, etc. There are, also, three organized day courses, arranged at different centres in the county, which are being attended by 36 sons of farmers. The remaining students are attending courses of instruction at the East Anglian Institute of Agriculture at Chelmsford. The Authority has also arranged a course of day classes for girls which began last month (January). The subjects dealt with in this course include horticulture, fruit preservation, dairying, poultry-keeping and beekeeping.

* * * * * *

Destruction of Weeds

RETURNS have now been received from all the County Agricultural Committees in England and Wales showing the number of cases, dealt with under the provisions of the Corn Production Acts (Repeal) Act, 1921, for the destruction of weeds, during the year ended September 30, 1930. The figures for each year from 1922 to 1930 are summarized below, and include cases in London or County Borough areas for which no Agricultural Committee exists, and which were dealt with by the Ministry direct. Cases

settled satisfactorily by arrangement without reference to the Agricultural Committees are also included :—

	Year ended September 30								
	1922	1923	1924	1925	1926	1927	1928	1929	1930
Total number of cases	269	1,010	1,530	1,514	2,409	2,927	3,593	4,331	5,452
Dealt with by arrangement ..	187	919	1,426	1,323	2,125	2,709	3,356	4,095	5,150
Notices served ..	82	91	104	191	284	218	237	236	392
Prosecutions :—									
Successful ..	1	6	9	14	12	5	8	10	*6
Unsuccessful ..	—	3	—	1	2	1	2	—	—

* Five additional prosecutions pending.

* * * * * *

Horticultural Advisory Council

A RESOLUTION expressing appreciation of the Ministry's action in regard to cherries imported from France, and suggesting that the prohibition date of importation from each zone should be further advanced, was passed at a meeting of the Horticultural Advisory Council, held on December 16, 1930. Another resolution recommended the continuance of the Importation of Raw Apples Order, under which low grade and unclassified apples are prohibited entry from the United States of America before the middle of November in each year. The Ministry was further urged to take immediate measures to prevent the importation from France of potatoes likely to introduce the Colorado Beetle into this country; also to proceed with a scheme for the application of the National Mark to jam made only from home-grown fresh fruit and sugar. Approval was expressed of the application, which may be made by the Horticultural Trades Association, for an Order-in-Council under the Merchandise Marks Act, 1926, for the marking of imported plants, trees and shrubs.

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British specimen of the grey squirrel.

Photo: A. D. Middleton.

THE GREY SQUIRREL IN THE BRITISH ISLES

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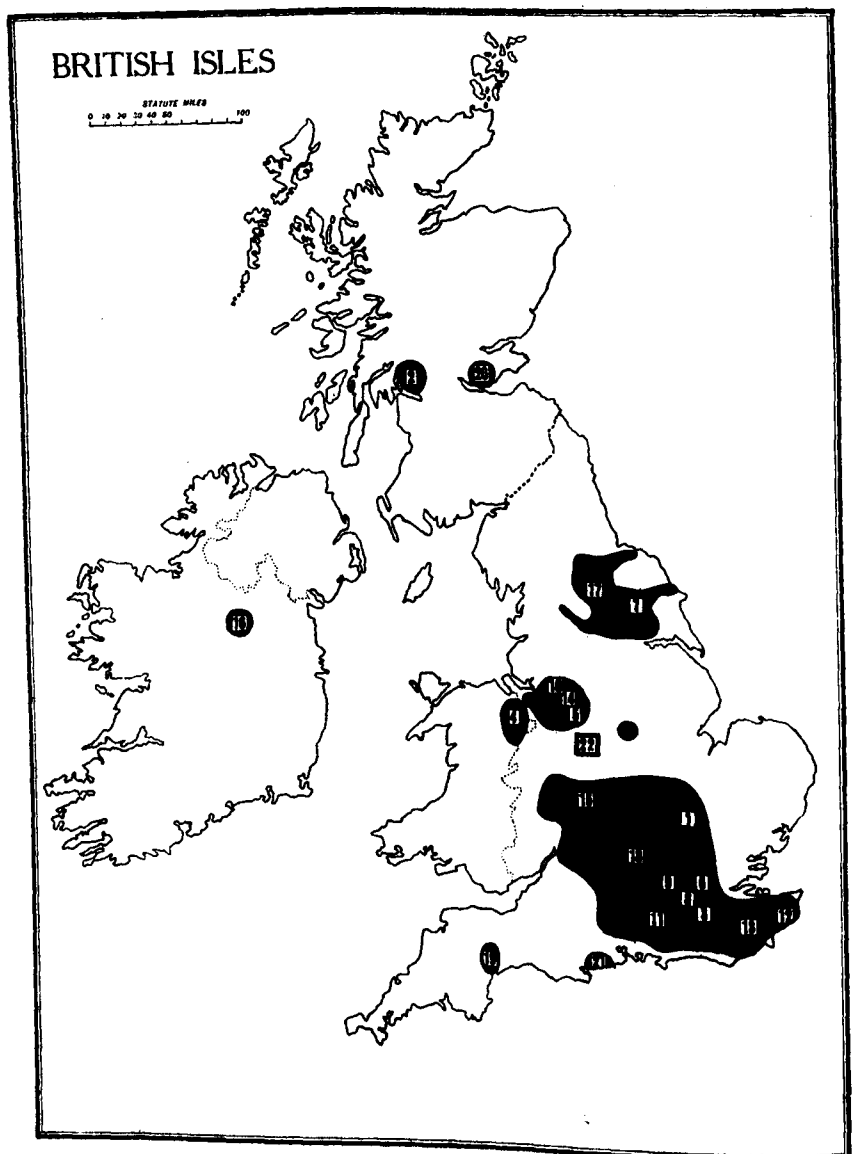
[*The data on which this article is based constitute a part of the results of research on wild rodents carried on at Oxford with the aid of a grant from the Empire Marketing Board. The preliminary results of the investigation that is being made into the spread of the grey squirrel have been published in detail in the Proceedings of the Zoological Society of London,* 1930, *part* 3, *and readers desiring more complete information on the subject are advised to refer to this publication. The investigations on the grey squirrel are being continued, and the writer would welcome any further items of information.*]

Description.—The American grey squirrel (*Sciurus carolinensis*) is a native rodent of the northern United States and southern Canada, where it is common in all the large deciduous forests, but does not extend its range far northwards into the coniferous belt. There are several varieties in America, but all those in the British Isles which have been examined by the writer conform to the description of the variety which inhabits north-eastern U.S.A. and south-eastern Canada.

Adult British specimens average about 1½ pounds in weight; the length of the body is about 12 inches, and the tail 9 inches. The general build of the animal is similar to that of the British red squirrel, but it is considerably larger. The colour effect is, at first sight, silver-grey, but there is a good deal of russet-brown coloration on all specimens; the brown colour is usually prominent on the top of the head, the centre line of the back, and the upper surface of the feet and ankles, while a line of brown runs along the sides at the junction of the white abdominal coat with the grey flanks. The individual hairs show several colour zones of black, white and brown, which are especially noticeable in the long hairs of the tail. The eyes are prominent, and the ears rather small and without the tufts of hair which characterize the winter coat of the red squirrel. Pure white albino specimens are not uncommon, especially in the south-east of England.

Introduction and Spread in the British Isles.—The widespread distribution of the grey squirrel in this country at the time of writing (November, 1930) undoubtedly results from the introductions that have taken place since 1889, but there are records of grey squirrels existing in certain areas as early as



Map showing the range of the Grey Squirrel in the British Isles in 1930, with main centres of dispersal marked. (*See page opposite.*)

1828. Up to this time it has been ascertained that grey squirrels were liberated at 33 separate points in various parts of the country during the period 1889-1930 ; in many of these instances, however, they appear to have died out or to maintain a very precarious existence. The accompanying map shows the *main* centres of dispersal, and the approximate area

covered by 1930. In the accompanying table will be found details of each of the introductions marked on this map.

The squirrels introduced in the first instance were obtained direct from America, and several other stocks have since been brought over independently, but most of the secondary centres were established with squirrels from one or other of the centres previously formed. The Woburn centre, started in 1890, has been the principal source of grey squirrels obtained for liberation on private estates and in public parks and pleasure gardens. Although the folly of introducing these animals and forming new centres of dispersal is now becoming generally recognized, it will be seen that one such centre was started as recently as 1929.

INTRODUCTION POINTS OF GREY SQUIRRELS

No. on map	*Locality*	*Date of introduction*
1	Woburn Park, Bedfordshire	1890
2	Loch Long-side, Scotland	1892
3	Richmond, Surrey	1902
4	Rossett, Denbighshire	1903
5	Lyme Park, Cheshire	1903–4
6	Regent's Park, London	1905–7
7	Near Malton, Yorkshire	1906
8	Kew Gardens, London	1908
9	Farnham Royal, Buckinghamshire	1908–9
10	Dunham Park, Cheshire	1910
11	Frimley, Surrey	1910
12	Sandling, Kent	1910
13	Benenden, Kent	—
14	Bramhall, Cheshire	1911–12
15	Edgbaston, Birmingham	1912
16	Newtownforbes, Ireland	1913
17	Near Bedale, Yorkshire	1913
18	Nuneham-Sandford, Oxfordshire	—
19	Rougemont Gardens, Exeter, Devon	1915
20	Dunfermline, Scotland	1919
21	Bournemouth, Hampshire	—
22	Needwood Forest, Staffordshire	1929
Other introductions of doubtful importance :—		
	Bushey Park, Middlesex	1889
	Stanwick, Northamptonshire	1918
	Cliveden, Buckinghamshire	—
	Bingley, West Yorkshire	1914
	Environs of Edinburgh	—
	Hebden Bridge, West Yorkshire	1921

It must be understood that the whole of the area marked on the map is not yet uniformly populated with grey squirrels, but represents the *range* of the animal by the autumn of 1930, and is based on a large number of reports from observers throughout the British Isles. The extension of range of the species is certainly not dependent on overcrowding in the

areas already populated, but appears to be the outcome of migratory instincts in individual squirrels, as isolated specimens or pairs frequently turn up suddenly as far as 20 miles from any previously populated locality. The border zones of the mapped areas are therefore generally very sparsely populated with grey squirrels at the present time; also, in the areas where the squirrel has been established for a long time, the distribution is by no means uniform, as they tend to congregate in some localities and leave others practically untouched. The population, calculated from numbers shot and seen in some of the most infested districts, has been found to reach as much as 3 per acre in favourable conditions. There is considerable evidence that the extension of range takes place rapidly along a river valley and is severely checked by hill country, especially moorland, such as the Cleveland Hills in Yorkshire.

The approximate distribution in each county concerned is given below in tabular form. From the progress already made, there seems little doubt that the grey squirrel will eventually populate the whole country, unless a successful means of extermination can be evolved, although the evidence available indicates that the mountainous country of North Wales, Cumberland and Northern Scotland will be less troubled by them than the lowland areas.

South-East England and the Midlands:

Kent: Practically the whole county.
Sussex: Nearly all except the south-eastern portion.
Surrey: The whole county.
Hampshire: The north-eastern half of the county.
Bournemouth: Gardens and environs of the town.
Middlesex: The whole county, where favourable.
Essex: Very few on extreme west of the county.
Hertfordshire: All except the north-eastern corner.
Cambridgeshire: The south-western borders.
Bedfordshire: The whole county.
Huntingdonshire: The southern part of the county.
Northamptonshire: All except the north-eastern portion.
Buckinghamshire: The whole county.
Oxfordshire: The whole county.
Berkshire: The whole county.
Wiltshire: Northern part, sparsely populated.
Gloucestershire: The north-eastern half of the county.
Warwickshire: Practically the whole county.
Worcestershire: Northern portion, sparsely populated.
Herefordshire: Few in north-eastern corner.
Shropshire: Few in south-eastern corner.
Staffordshire: Few in southern portion.
New centre (1929) in Needwood Forest.
Leicestershire: A few in the south of the county.
Devonshire: Environs of Exeter and northwards up Exe valley.
Nottinghamshire: Several recorded near Nottingham, but origin unknown.

Cheshire and North Wales area:

Cheshire: About three-quarters of the county in the north and east.
Denbighshire: The eastern quarter of the county.
Shropshire: The north-western borders.

Yorkshire area:

East Riding: North-western half of the Riding.
West Riding: North-eastern portion, and Wharfedale.
North Riding: Most of the eastern three-quarters, except the Cleveland Hills.
Durham: Few in the south; west of Darlington.

Scotland:

Dumbartonshire: Practically the whole county.
Stirlingshire: Few in north-western portion.
Fife: A few miles radius round Dunfermline.
Edinburgh district: Several escapes from Zoo at Corstorphine.

Ireland:

County Longford: The district of Newtownforbes.

Habits, Food and Damage.—Grey squirrels appear to favour mixed deciduous woods, parklands, orchards and gardens, rather than the dense coniferous woods, which are the ideal habitat of the red squirrel. They spend a great deal of time on the ground, and are frequently seen in hedgerows and fields as much as half a mile from any wood or plantation. Few accurate data are yet available regarding their rate of reproduction, but such reliable evidence as there is indicates that an average of four young to the litter is usual, the maximum being six. One or two litters are raised in the breeding season. Although the evidence available is not yet conclusive, the young do not appear to breed in the year of their birth; the length of life in normal conditions is not known, but probably varies from three to six years.

The food of the grey squirrel is as varied as its habitat—much less specialized than that of the native red squirrel. The following is a list of the different kinds of foods eaten; the order of this list is relative to the amount of each class of food eaten, the most common foodstuffs being placed first and the occasional ones last:—

Green shoots and buds of various trees, coniferous and deciduous.
Nuts and seeds in all stages, ripe and unripe.
Fruits, wild and cultivated, ripe and unripe.
Inner bark of young trees, notably beech and sycamore.
Bulbs and roots of various kinds.
Birds eggs.
Young birds.
Carrion.

Each of these categories embraces numerous items, the eating of many of which is certainly destructive to marketable produce, and of economic importance. The destruction of

young shoots and buds of trees has serious effects upon the growth of the tree. As regards young forest trees, especially conifers, the leaders are frequently bitten off and a consequent distortion of the tree ensues, making the ultimate timber of little value. As for fruit-trees, the destruction of buds in the spring has a pronounced effect upon the yield of fruit. Practically every kind of fruit appears to be eaten with avidity, and the systematic collection and removal of all kinds of nuts in an unripe stage is a very widespread practice among grey squirrels. During the spring and early summer, a favourite food is the succulent inner bark of young trees, the sap-bearing layer being peeled completely off large patches, often girdling the tree, on trees of 10-20 years' growth. Beech and sycamore appear to be especially subjected to this form of damage, and thousands of young trees of these species have been killed by the squirrels. The bark of the Scots pine, a favourite food of the red squirrel, appears to be little touched by the grey species.

The destruction of birds' eggs by grey squirrels has caused a great deal of consternation, but, though there is no doubt that egg-eating is a frequent and serious offence, it cannot be so prevalent as many people believe. The grey squirrel would long ago have eliminated the entire resident bird population from many of its present strongholds had it been *particularly* addicted to nest-robbing: it is difficult to imagine any animal better suited to the practice of finding and robbing birds' nests. Nevertheless, there are many eye-witness accounts of grey squirrels eating eggs, and it is certain that such a food is very palatable to them. Taking all the evidence together, it appears that grey squirrels readily eat any eggs that they may find "accidentally" in the course of their normal wanderings: it matters not to the squirrel whether these are eggs of domestic fowls, game-birds, wood pigeons or sparrows. The same argument probably applies to the eating of young birds, of which there are many authentic records. The writer has no wish to under-emphasize the importance of this habit, but merely to state that eggs or young birds are an occasional, rather than a normal, item in the grey squirrel's diet. It is perhaps fortunate for the birds concerned that the nesting time coincides with a period of plenty in plant food for the squirrels, and thus the necessity of vigorous searching for food is obviated. One or two instances are recorded of young rabbits being killed and eaten in the nest, but there appears to be no ground for alarm on this point.

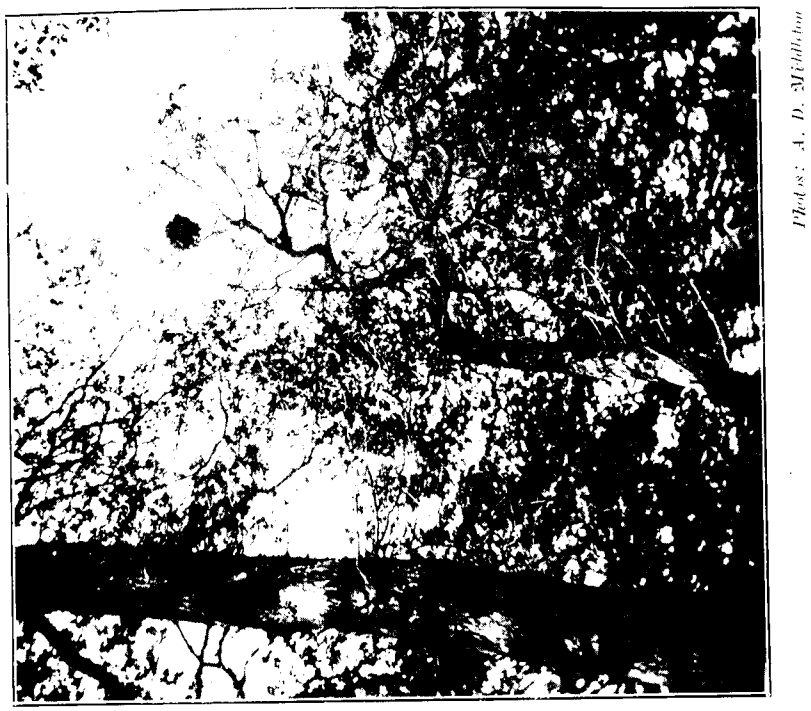


Photo: A. D. Middleton

A nest (or drey) of the grey squirrel

A young sycamore tree from which large patches of bark have been peeled by grey squirrels.

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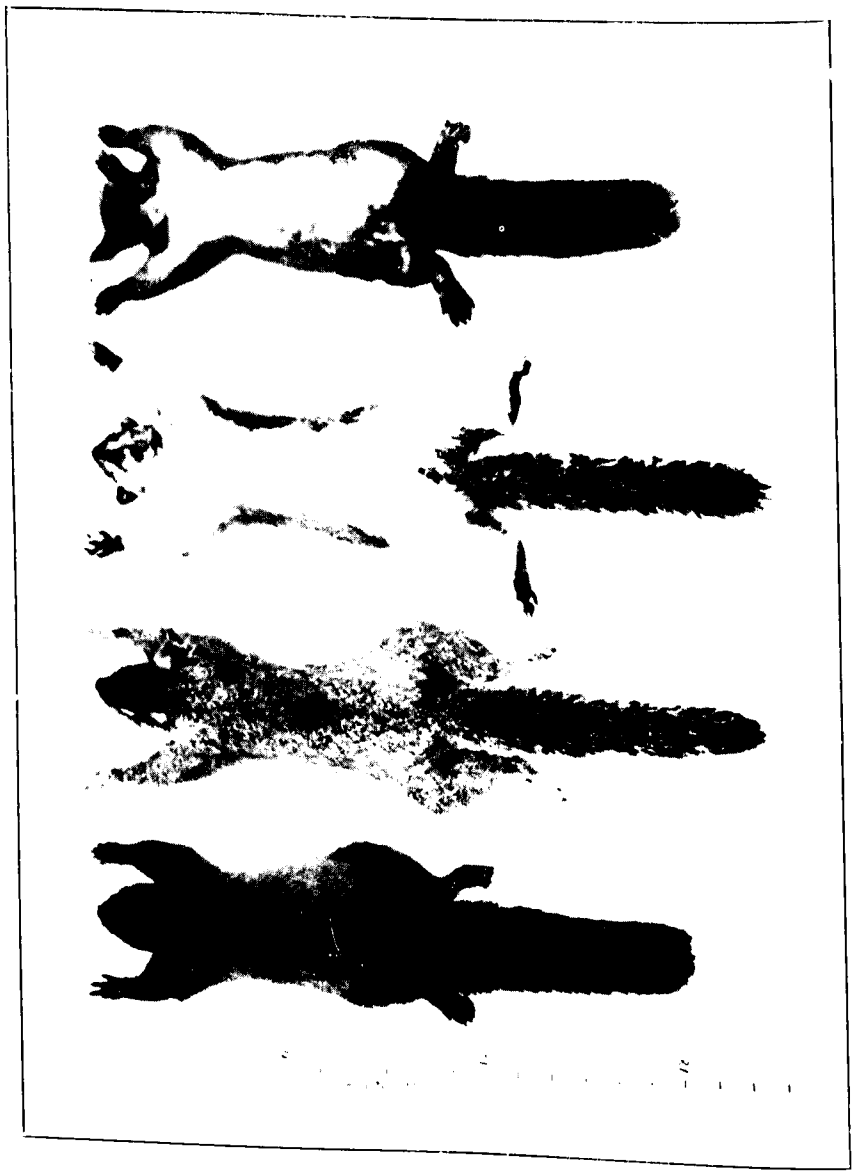

Red. Grey. Grey. Red.

Comparative view of the English red with the grey squirrel.

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Economic Effects.—Our experience of the depredations of the grey squirrel, during the latter part of its forty years' residence in this country, leaves little room for doubt that a uniform population throughout the British Isles would inevitably become a serious burden, both direct and indirect, and at the present rate of increase such a position will probably be reached in a very short time. Whereas the destructive habits of the red squirrel are more or less limited to certain aspects of forestry, those of the grey cause a considerable toll on forestry, agriculture, fruit growing and the bird life of the country. The growth of forestry in this country during the past ten years is leading to a remarkable change in the conditions of life for squirrels; within 50 years it is likely that there will be nearly a million acres of new forests, all of which are being raised as a strictly economic proposition. Such a state of affairs will be ideal for the support of a large squirrel population, but the business of forestry can ill afford the losses that it must suffer from such a pest. It is impossible to estimate the extent of the damage that may be caused by grey squirrels in young forests, as so much depends upon their preference for particular habitats and possible changes in their feeding habits in a changing environment, but it is certain that whenever squirrels feed in a young plantation they damage.

The exact effect of this additional rodent population on general agriculture is difficult to determine at the present stage, but, in any highly-cultivated area, no rodent can exist without doing appreciable damage to agricultural produce. In the past, squirrels have been of little or no consequence to agriculture, but this cannot be said of this new arrival with such a varied diet, considering the increasingly intensive nature of agriculture. In this respect the horticulturist becomes a particular object for the attention of grey squirrels. It has already been shown that the rapidly growing industry of fruit farming is especially liable to the depredations of these animals, and a high concentration in fruit-growing areas would certainly be a problem of considerable magnitude. Finally, the indirect results of the destruction of beneficial insectivorous birds by a grey squirrel population might become of serious significance to both forestry and all forms of agriculture.

On the other hand, it is possible that the fur of the British grey squirrel may be found of equal value to that of American and Continental origin, and the formation of a reasonable market for the pelts may give rise to a profitable new industry.

The flesh of the grey squirrel is well known to be very palatable and suitable for human consumption, but there is a curious and unfounded prejudice against its use for such a purpose. It is doubtful, however, if any benefits which may accrue from grey squirrels can ever weigh much against the enormous drain on the resources of the country that their presence is bound to entail.

Methods of Control.—The grey squirrel is not a difficult animal to keep within reasonable bounds if concerted action is taken against it, although its total extermination would be almost impossible by any means available at the moment. It is not so much the *manner* of killing it that needs emphasis as the *necessity* for killing it: if it continues to be tolerated, and even fostered, by a large number of people, as it certainly is at present, its increase can never be checked. The general attitude towards this animal will determine whether it is to be kept under efficient control, and there is ample evidence to prove that it should be treated as a dangerous pest.

Shooting and trapping are the only methods at present available of keeping down the numbers of this pest, since the poisoning of such an animal can rarely be carried out with safety; but it is hoped that future research into the question of specific diseases will do much to simplify the problem of controlling this and other rodents. By rigorous shooting at all seasons of the year a great deal can be done to check the increase; dogs can readily be trained to give valuable assistance in squirrel hunting, both by finding the animals and driving them into view of the gun—a most important point, as otherwise these squirrels are extremely adept at keeping the trunk of a tree between themselves and a charge of shot. A most satisfactory method is for two guns and a dog to work together, as the squirrels, when "marked" by the dog, are then invariably within reach of one of the guns. A ·410 shot gun or ·22 sporting rifle serves admirably for squirrel shooting, and the latter provides an additional element of sport. A powerful air-rifle is also quite efficient for the purpose, and is especially suitable for the private owner of a small estate or garden who does not care for noise and the trouble of gun licences or permits.

Many keepers make a practice of putting a charge of shot into any new squirrel nests seen in the spring, and this is to be recommended to farmers and keepers generally as a frequently successful mode of attack in the course of an

ordinary tour of inspection on a farm or estate. Particular attention should be paid to the killing of the first grey squirrels seen in a district, for, as already explained, isolated pairs frequently trek over considerable distances, and if allowed to settle down and breed will soon be the source of a new infestation, while, by timely shooting, such an event may be forestalled for many years. It is well worth while spending a whole day hunting down the first pair of grey squirrels that appear in a particular district.

The formation of squirrel clubs, or general vermin clubs, among landowners and farmers is strongly recommended as giving an incentive for keeping down the number of grey squirrels. The Highland Squirrel Club, which has been in active existence for nearly 30 years in the north of Scotland for the purpose of killing red squirrels, is an excellent example of this type of club, and has so far accounted for over 80,000 squirrels. Members pay an annual subscription varying according to the acreage of their estates, and the funds are used for paying a "tally" of from 3*d*. to 6*d*. a tail for all squirrels shot on members' estates. By such a system, some members who rigorously shoot down their squirrels actually receive considerably more in "tally money" than they pay in subscriptions. County grey squirrel clubs on these lines could readily be organized by agricultural and arboricultural societies, or branches of the National Farmers' Union, and the writer would be pleased to offer detailed suggestions and advice on the formation of any such clubs that may be contemplated.

Trapping, except in particular instances, is not usually favoured by farmers, but gamekeepers will readily apply this method of keeping down grey squirrels, and there is little need to offer them any advice on the subject. It has been found by many keepers that these squirrels are easily attracted to flesh and egg baits by exactly the same procedure as is adopted for stoats, and in this respect the tunnel trap has been proved to be very efficient. It should, however, be noted that the use of spring traps, except in rabbit holes or similar situations, is prohibited by the Ground Game Act, 1880, and that, having regard to the Wild Birds Protection Act, 1904, the fixing, placing or setting of any traps or similar instrument on any pole, tree or cairn of stones or earth, for the purpose of catching grey squirrels is not permissible as the law stands at present. A very useful trap where the squirrels are numerous is a wire-netting cage, two or three feet square, with a "sleeve"

entrance either at the top or side, corn being used as a bait; such a trap has the advantage of remaining set for an indefinite period, and any other animals or birds which are caught accidentally can readily be released.

In conclusion, the importance of adopting a definitely inimical attitude towards grey squirrels cannot be over-emphasized, for there is every reason to believe that these aliens will quickly become an unmitigated pest of a hitherto unknown character throughout the country, unless determined action is taken against them by all concerned.

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WINTER SPRAYING FOR THE CONTROL OF THE APPLE CAPSID BUG

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STANILAND and Walton have shown that the Long Ashton tar-distillate wash, applied at a 10 per cent. concentration during the dormant season, is capable of effecting a marked reduction of the Apple Capsid Bug (*Plesiocoris rugicollis*) on some varieties of apples in certain districts. The experiments here described were undertaken with the object of discovering an effective means of preventing the hatching of the eggs of this pest in the Eastern counties.

Experiment No. 1.—This was carried out, in 1929, at Friday Bridge, near Wisbech, in collaboration with Mr. W. G. Kent, Horticultural Superintendent for the Isle of Ely. As the ordinary Long Ashton wash is not suitable for use with the hard, dyke waters of the district, a modified Long Ashton wash (one solution) was used in this instance. The excessive hardness of the dyke water made it necessary to add size to the ordinary tar-distillate wash* to secure a satisfactory emulsion. Each plot consisted of about 20 trees of the Bramley's Seedling and Grenadier varieties, 14 years old.

The plots were separated from each other by two rows of Grenadiers. The spraying took place on March 6 and 7, the spray being applied by means of a 1½ h.p. petrol pump supplying two nozzles. On June 6, a count was made of the

* Tar-distillate wash, or ordinary tar-distillate wash, is the name given to a number of proprietary washes made from tar-distillates without removal of the tar acids. Such washes have been used in this country for several years.

number of marked shoots on the lower half of the Grenadier trees, the results being recorded in Table I.

TABLE I.—FRIDAY BRIDGE (GRENADIERS)

Plot		*Average No. marked shoots per tree*
3	Control	245
4	Mineral oil emulsion B, 7 per cent.	45
5	Modified Long Ashton wash, 12 per cent. ..	70
2	,, ,, ,, ,, 10 ,, ..	73
6	Tar-distillate wash, 12 per cent.	158
1	,, ,, 10 ,, ...	196

As a result of severe frost injury, the crop was a poor one, and the apples, although graded, were not sufficiently numerous to give reliable results. The mineral oil emulsion used gave the best control of the Apple Capsid, but failed to control the Rosy Apple Aphis (*Anuraphis roseus*), although the attack of the latter pest was only slight on the control trees. It was, however, readily controlled by the other washes.

Experiment No. 2.—A similar experiment was carried out, in 1929, at Burwell, Cambridgeshire, in collaboration with Mr. A. T. Paskett, the County Horticultural Adviser. Here, each plot consisted of 12 trees of the Grenadier variety. The spraying, which took place on March 8, was effected by a headland pump, giving a pressure of about 80 lb. per sq. in., and supplying two nozzles. On June 4, a count was made of the number of shoots attacked by the Apple Capsid Bug on the lower parts of the trees. The result is given in Table II.

TABLE II.—BURWELL, CAMBRIDGESHIRE (GRENADIERS)

Row		*Average No. marked shoots per tree*
5	Control	114
8	Mineral oil emulsion B, 7 per cent.	14
4	Modified Long Ashton wash, 12 per cent. ..	18
7	Tar-distillate wash, 10 per cent.	24
3	,, ,, 12 ,, ...	26
6	Modified Long Ashton wash, 10 per cent. ..	79

As a result of severe frost, there were not sufficient apples to give reliable results. The mineral oil emulsion again gave the best control, but this was the first occasion on which the writers had seen such a large reduction of capsids effected with an ordinary tar-distillate wash.

The results obtained in the above two experiments, taken together with those obtained by Staniland and Walton, using Long Ashton wash and modified Long Ashton wash, suggested that the trials might be continued another year and that they might include mixtures of the mineral oil emulsions with the Long Ashton wash or modified Long Ashton wash.

Experiment No. 3.—This was carried out, in 1930, at Bluntisham, Huntingdonshire, in collaboration with Mr. F. Tunnington, the County Horticultural Organizer. Each plot consisted of about 10 trees of the Bramley's Seedling variety. Spraying was carried out, on February 18, by means of a horse-drawn, barrow-type hand-pump, giving a pressure of about 80 lb. per sq. in., and supplying two nozzles. The temperature was low, there being ice on the top of the dyke water from which a supply was drawn. About 4 gal. of wash were used on each tree. For the mixed washes, the tar-distillate containing an emulsifier was poured into the water, caustic soda being subsequently added and the mixture emulsified by thorough stirring; the mineral oil emulsion was then added. On July 18, a count was made of the total number of apples on each tree, and the percentage marked by the Apple Capsid Bug was determined. The results are given in Table III.

TABLE III.—BLUNTISHAM, HUNTS (BRAMLEY'S SEEDLING)

Treatment	*Average total No. of apples per tree*	*Percentage of marked apples*
Control (one plot and two half-plots) ..	22	52·8
Mineral oil emulsion B, 7½ per cent., plus L. Ashton, 7½ per cent. ..	55	2·0
Mineral oil emulsion A, 7½ per cent., plus L. Ashton, 7½ per cent. ..	64	2·3
Long Ashton, 12½ per cent.	113	7·0
Mineral oil emulsion A, 7½ per cent...	105	7·1
Long Ashton, 10 per cent.	139	14·6

On October 6, the apples on these trees were picked, graded and weighed, results being as shown in Table IV.

TABLE IV.—BLUNTISHAM (BRAMLEY'S SEEDLING)

Treatment	*Av. weight of apples per tree lb.*	*Percentage weight of apples*		
		Badly marked	*Slightly marked*	*Clean*
Control	9	47·6	14·5	37·9
Mineral oil emulsion B, 7½ per cent., plus L.A., 7½ per cent.	18½	0·9	1·2	97·9
Mineral oil emulsion A, 7½ per cent., plus L.A., 7½ per cent.	30	2·3	1·7	96·0
Long Ashton, 12½ per cent.	38	6·6	2·0	91·4
Mineral oil emulsion A, 7½ per cent.	46	10·3	3·4	86·3
Long Ashton, 10 per cent.	46	23·4	2·6	74·0

It will be seen, from Tables III and IV, that the mixture of the Long Ashton wash and either of the mineral oil emulsions used gave a very good control of the Apple Capsid Bug; that Long Ashton wash at 12½ per cent. gave a good control; that mineral oil emulsion A, alone, at a concentration of 7½ per cent., gave a fairly good control; but that only a moderate control was given by Long Ashton wash when used at a concentration of 10 per cent. Considerable differences in the yields of the plots will also be noticed. Although the number of trees is not sufficient to give critical results, some reasons may be offered for these variations.

The very low yield of the control plots is attributable chiefly to attacks of Winter Moth caterpillars assisted by the Apple Capsid Bug. All the sprays used gave a good control of caterpillars, and the foliage growth was very good. The reduction in the yield of the plots, sprayed with a mixture of Long Ashton wash and a mineral oil emulsion, was caused by the killing of a number of the fruit buds. This mixture also retarded the opening of the blossoms; at blossoming time the trees appeared to be suffering badly from spray damage. Long Ashton wash, at a concentration of 12½ per cent., also retarded the opening of the blossom buds, but killed very few of them. Long Ashton wash, at a concentration of 10 per cent., retarded the opening of the fruit buds, but no damage was noticed on this particular plot. Mineral oil emulsion A, at a concentration of 7½ per cent., caused no damage to the fruit and no retardation.

Summer Spraying.—To compare the value of winter with summer spraying, two of the neighbouring plots at Bluntisham were sprayed, on May 15, 1930, with soft soap and nicotine and with a pyrethrum wash, respectively. The results of counts, made on July 18, are detailed in Tables V and VI.

TABLE V.—BLUNTISHAM, HUNTS. SUMMER SPRAYING (BRAMLEY'S SEEDLING)

Treatment	*Average No. of apples per tree*	*Percentage of marked apples*
Control (one plot and two half-plots)	22	52·8
Soft soap, 5 lb., plus nicotine (95-98 per cent.), 4 oz., water, 40 gall. ..	57	6·4
* Pyrethrum A, 1 part in 80 parts of water	54	7·6

TABLE VI.—BLUNTISHAM, HUNTS, SUMMER SPRAYING (BRAMLEY'S SEEDLING)

Treatment	*Av. weight of apples per tree lb.*	*Percentage weight of apples*		
		Badly marked	*Slightly marked*	*Clean*
Control	9	47·6	14·5	37·9
Soft soap, 5 lb., nicotine (95-98 per cent.), 4 oz., water, 40 gall.	14	3·4	7·6	89·0
Pyrethrum A, 1 part in 80 parts of water	16	4·2	5·8	90·0

* A proprietary wash containing pyrethrum. This dilution is the equivalent of 1 per cent. of pyrethrum flowers.

From these figures, it will be seen that soft soap and nicotine gave as good a control of the Apple Capsid Bug as did the Long Ashton wash at 12½ per cent., and that the pyrethrum wash gave a similar result. The low yields shown in Table VI were due to caterpillar attack.

Experiment No. 4.—This was carried out, in 1930, at Wisbech St. Mary, in collaboration with Mr. W. G. Kent, Horticultural Superintendent for the Isle of Ely. As the dyke waters of the district are very hard, rainwater was used for making the Long Ashton wash, but dyke water was used for the other washes. The trees (variety, Lord Derby) were 16 years old and planted 24 ft. by 12 ft. The experimental area consisted of 54 rows of 4 trees each, and each plot consisted of 8 trees. Some of the plots were sprayed early and some late, the object being to discover whether the date of spraying has any important bearing on the results. The early spraying took place on January 27 and 28, and the late spraying on March 3. On both occasions, a headland hand-pump, supplying two nozzles, was used.

On September 19, 20 and 21, the apples were picked and graded into four divisions :—

(1) Clean.

(2) With slight Capsid markings (most of these apples were sent to market).

(3) With moderate Capsid markings (these were not suitable for sending to market).

(4) With bad Capsid markings.

The results are set out in detail in Table VII.

In Table VII, considerable variation in the yields of the various plots will be noticed. This was attributable in large measure to caterpillar attacks, the chief culprit being Winter Moth. The control plots were badly attacked. The plots on which mineral oil emulsion was used, at a concentration of 7½ per cent., also suffered moderately badly. At a concentration of 10 per cent. there was very little caterpillar attack and practically no reduction in yield from this cause. The mixture of modified Long Ashton wash and mineral oil emulsion, applied late, gave the best control of the Apple Capsid Bug, but killed a number of fruit buds and, consequently, reduced the crop.

In connexion with the damage to the apple fruit buds, it must be remembered that the winter of 1929-30 was an exceptionally mild one, and this may have had some influence on the amount of damage done.

TABLE VII.—WISBECH (VARIETY, LORD DERBY), 1930

Notes.—Early spraying, January 27 and 28 : late spraying, March 3. L.A.—Long Ashton Wash. L.A.M.—Modified Long Ashton Wash.

Spray	*No. of plots*	*Weight of apples per tree lb.*	*Percentage weight of apples*			
			Bad markings	*Moderate markings*	*Slight markings*	*Clean*
Min. oil emulsion A, 7½ per cent., plus L.A.M., 7½ per cent. Late ..	1	89½	7·2	8·1	17·9	66·8
Min. oil emulsion B, 7½ per cent., plus L.A.M., 7½ per cent. Late ..	2	74	9·1	8·5	24·0	58·4
Min. oil emulsion B, 10 per cent. Late ..	1	98¼	13·4	14·7	21·6	50·2
Min. oil emulsion B, 5 per cent., plus L.A.M., 5 per cent. Late	1	86¾	7·2	19·8	23·0	50·0
Min. oil emulsion A, 7½ per cent., plus L.A.M., 7 per cent. Early ..	2	105¾	12·0	14·5	25·5	48·0
Min. oil emulsion A, 7½ per cent. Late	1	98	10·1	18·4	35·5	36·0
L.A.M., 12½ per cent. Early	2	116¼	20·6	21·0	25·0	33·3
Min. oil emulsion B, 10 per cent. Early ..	1	100	9·6	25·2	37·0	28·2
L.A., 10 per cent. Late ..	1	113¼	33·8	19·1	22·2	24·9
L.A.M., 12½ per cent. Late	2	94½	29·9	24·1	21·1	24·9
L.A., 10 per cent. Early..	2	120	30·8	30·2	16·4	22·6
L.A.M., 15 per cent. Early	2	102	37·7	20·2	20·0	22·1
Min. oil emulsion B, 7½ per cent. Late ..	1	66¾	28·8	35·8	18·0	17·4
Min. oil emulsion A, 7½ per cent., plus L.A., 7½ per cent. Early ..	1	112½	35·4	20·8	26·4	17·4
L.A., 12½ per cent. Early..	2	95	32·2	38·8	17·1	11·9
Min. oil emulsion A, 7½ per cent. Early ..	1	54	74·3	13·9	8·1	3·7
Control	4	19	67·9	19·8	7·0	5·2

Table VII indicates that neither the Long Ashton wash nor the modified Long Ashton wash used gave a satisfactory control of the Apple Capsid Bug. The best result was obtained with a Long Ashton modified 12½ per cent. solution, but it produced only 33 per cent. of clean apples. The Long Ashton wash at 12½ per cent. gave only 12 per cent. of clean apples, a result the writers are unable to account for in any way. Mineral oil emulsion B, applied at a concentration of 10 per cent., gave moderately good results ; but these emulsions, at a concentration of 7½ per cent., gave disappointing results, with the exception of mineral oil emulsion A, applied late. The best control of the Apple Capsid Bug was given by a mixture of the Long Ashton modified wash with a mineral oil emulsion wash, both at a concentration of 7½ per cent., applied late. One of the early mixtures gave very poor results.

Time of Spraying.—In Experiment No. 4, an attempt was made to decide whether early or late application of the washes was an important factor. In two instances, the duplicate plots gave a wide variation, showing that the experimental error in this trial was very high; consequently, it is not safe to draw definite conclusions. When mineral oil emulsions are employed, the time of application seems to have an important bearing on the results obtained. The late application (March 3) of both emulsions A and B gave a much better control of the Apple Capsid Bug than the early spraying on January 27. With the Long Ashton wash, the time of application made no significant difference in the results obtained; nor do the figures give any indication whether it is better to apply the Long Ashton modified wash late or early. With both mixtures of the modified Long Ashton wash and mineral oil emulsions, the late application (March 3) gave a much better control of the Apple Capsid Bug than the early one (January 27).

The figures suggest that better results are likely to be obtained with mineral oil emulsions, and mixtures containing mineral oil emulsions, if these are applied as late as possible. A number of growers in the Wisbech district have formed the opinion that late spraying gives them better results than early spraying with Long Ashton or modified Long Ashton washes.

Varietal Differences.—Good results were obtained in the foregoing trials with mineral oil emulsions, Long Ashton wash and modified Long Ashton wash when the variety of apples sprayed was either Bramley's Seedling or Grenadier. In Experiment No. 4, where the variety was Lord Derby, these washes gave disappointing results. In this connexion it is interesting to note that, in the experiments conducted by Staniland and Walton, in 1929,* the Long Ashton wash also gave a poor control of the Apple Capsid Bug on the variety Lord Derby. This wash, at 10 per cent. concentration, was applied (March 9) on Lord Derby apples at one centre only (Wilmington, Kent). Poor control was also given on this variety by the modified Long Ashton wash at 10 per cent. when applied (March 8 and 9) at two centres in Kent. Yet at one of the centres (Crockenhill) 10 per cent. modified Long Ashton wash, applied to Bismarcks on March 9, gave a good control of the Apple Capsid Bug.

* *Vide* Annual Report of the Long Ashton Research Station, 1929.

In some experiments, carried out by Col. M. C. Clayton in his orchard at West Walton, near Wisbech, in 1930, and visited periodically by the writers, a good control of the Apple Capsid Bug on the variety Lord Derby was obtained by spraying, during the third week in March, with a 10 per cent. Long Ashton wash. At the same time, a fairly good control resulted from the use of a 10 per cent. modified Long Ashton wash. With both washes, however, better results were obtained on Bramley's Seedling.

These results suggest that control of the Apple Capsid Bug by winter spraying is less effective in the case of the Lord Derby variety than with other varieties, such as Bramley's Seedling. The position of the eggs and the structure of the shoots do not suggest any explanation for the varying results.

There would appear to be a marked difference, also, in the susceptibility of varieties to fruit-bud injury; Bramley's Seedling buds, for example, suffered injury in orchards where those of Lord Derby were unaffected, although both were sprayed on the same day and with the same wash.

Control Measures.—From the above results, from those of other workers, and from observations made in a number of orchards, it is difficult to determine which is the most economical method of reducing Apple Capsid Bug by winter spraying. There appear to be five possible methods:—

1.—*Spraying with Long Ashton Wash at a Concentration of 10 per cent.*—This has given good results in some orchards, but not in others. In 1930, gooseberries and strawberries, growing under trees sprayed with this wash, were seriously injured. Consequently, it is dangerous to use it where trees are under-cropped with the fruits named. In some cases, this wash retarded the opening of the apple blossom buds and a few were killed by it. It must be remembered that this wash is made by a number of different firms, and there appears to be a marked variation in the products placed on the market under the name of "Long Ashton Wash." *It is important, therefore, that the wash should be made according to the Long Ashton specification.*

2. *Spraying with modified Long Ashton Wash at a Concentration of 12½ per cent.*—This should be used only where the available water is too hard for making the Long Ashton wash, or until such time as a modified wash is obtainable which gives as good results as the Long Ashton wash. There are a number of modified Long Ashton washes on the market;

some appear to give better results than others, but even the best have given poor results in a number of orchards. In 1930, some of them seriously damaged gooseberries and strawberries growing beneath trees that were sprayed, and some of them killed a number of blossom buds, especially on the variety Bramley's Seedling, whereas other modified Long Ashton washes caused no injury to Bramley's Seedling in the same orchard.

3. *Spraying with Mineral Oil Emulsion at a Concentration of 7½ per cent., or rather higher.*—The power of these proprietary washes to prevent Apple Capsid eggs from hatching varies considerably. Some of them, at a concentration of 7½ per cent., have given rather better results than Long Ashton washes at a concentration of 10 per cent., although the results on Lord Derbys have been very variable. Very little damage to apple trees or undercrops has resulted from the use of these washes. Their great drawback is failure to control attacks of aphides; and they do not give such a good control of caterpillar as the previous washes. In several instances, however, they have given a good control of Red Spider (*Oligonychus ulmi*). Late applications of these washes have given the best control of the Apple Capsid Bug. Where Winter Moth is likely to cause loss of crop, trees that have been sprayed with a mineral oil emulsion only should be banded to prevent the females from laying eggs.

4. *Spraying with a Mixture of Mineral Oil Emulsion and Long Ashton Wash (or modified Long Ashton Wash or ordinary Tar-distillate Wash*).*—These mixtures have given the best control of the Apple Capsid Bug at concentrations, however, that caused the most injury to the apple fruit buds and to undercrops such as gooseberries and strawberries. Late applications have given the best control.

Staniland and Walton† gave the composition of a mixture of this kind that controls both the Apple Capsid Bug (*Plesiocoris rugicollis*) and the Common Green Capsid Bug (*Lygus pabulinus*) on black currants without causing injury. A mixture of this kind, containing sufficient tar-distillate to control aphides and sufficient mineral oils to give a big reduction of Capsids and Red Spider, appears to be the most promising as a general winter wash for the control of insects on apple

* In cases where the two emulsions will mix satisfactorily.

† This JOURNAL, August, 1930, p. 476.

trees on which the Apple Capsid Bug is present. It will probably be difficult to find a mixture of this kind that will not injure gooseberries and strawberries growing beneath.

5. *Spraying first with an ordinary Tar-distillate Wash at a Concentration of 5 or 6 per cent., and again, before the Buds begin to swell, with a Mineral Oil Emulsion at a Concentration of 7½ or 8 per cent.*—Ordinary tar-distillate wash is suggested as being cheaper than the Long Ashton wash or modified Long Ashton washes, which would answer the same purpose as the ordinary tar-distillate wash for the control of the Rosy Apple Aphis. Some growers tried this in 1930, in the Wisbech district, with success. It has the disadvantage of being more expensive than the previous methods. In a mixed orchard of apples and plums, however, it suggests itself as being the best method for controlling the Apple Capsid Bug and Rosy Apple Aphis without causing serious injury to the plums. The plums would be sprayed with the tar-distillate wash to control Leaf-Curling Plum Aphis, but not with the mineral oil emulsion.

* * * * * *

ANIMAL PIGMENTS

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What Colour Means.—We live in a world rich in colour—of sea and sky, of mountains and precious stones, and, finest of all, of plants and animals. The colours are our sensations, due to what particular wave-lengths of light reach our retina, and thence excite our brain. When all the ordinary light-rays of different wave-lengths reach our eye, we see the common light of day or, it may be, a white object; but if only a *fraction* of the ordinary light reaches us, we see some colour or other according to the fraction. At the one end of the spectrum, familiar in the rainbow, there are the violet rays with shortest wave-length, some forty millionths of a centimetre long; at the other end are the red rays with longest wave-length, twice as long as the violet. According to the wave-length is the colour-sensation; and it is worth remembering that ants, as Sir John Lubbock first showed, can see the ultra-violet rays which are invisible to us, though happily we are not insensitive to their healthful influence. If we call visible light an octave, there are 61 other measured octaves of electro-magnetic vibrations, from the very short-waved rays used in radio-therapy to the very long ones used in broadcasting; and while different notes, so to speak, of the visible light octave call forth different colour-sensations, a blend of all the notes, as from snow, foam, clouds, and the like, produces the sensation of *whiteness*, for there is complete reflection of the whole light from the mirroring surfaces of crystals or bubbles as the case may be. When the light comes to our eye after passing through a coloured body or fluid, or after being reflected from a coloured surface, then it has been to some extent filtered or tampered with. Whenever that is the case, we see *colour*, which varies according to the nature of the filtering. Thus if the rays of longest wave-length (red) have been absorbed or in any way subtracted, then the object will appear green—the colour "complementary" to that which was filtered out. If "blue" is filtered out the object will appear "orange." We must not dwell on this physical aspect; the point is that "colour" is due to some interference with the wholeness of white light.

Three Kinds of Coloration.—Among plants and animals there are many substances, called *pigments*, the molecular structure of which is such that they interfere with the wholeness

of the light that passes through them or is reflected from them. In a rough way, they might be compared with paints, but this is a case where a simple comparison is not a very useful one, especially when we come to face certain peculiar "pigments" which have little or no colour! That a pigment may be colourless is a statement to disbelieve until one understands it.

As examples of organic pigments we may mention the two most important, chlorophyll in plants and hæmoglobin in animals, which are very different from one another, though with a good deal in common. The chlorophyll-pigments, for they are in the plural, absorb some of the orange-yellow-red rays, and use this energy to build up carbon dioxide and water into sugar and the like—the most fundamental vital process in the world. The red-blood-pigment or hæmoglobin of all higher animals owes its great importance to its power of capturing oxygen, *e.g.*, in the lining of the lungs, and of readily surrendering it again to the living matter of the body. The melanins of dark-coloured birds and beasts, *e.g.*, crow and Black Angus, are familiar examples of pigments; and everyone knows, though not by name, the reddish pigment (zoonerythrin) of shrimps and prawns, which is bluish in the lobster until it is boiled. First of all, then, the colour of an animal may be due to particular organic substances or pigments, whose structure is such that it somehow interferes with the wholeness of the white light that falls upon it.

In the second place, there may be brilliant colours without any pigment at all, as is plain enough from the iridescent soap-bubble. The bubble has all the colours of the rainbow, but it is only a transparent film of soap and water. Everyone knows the beautiful colours of mother-of-pearl; but if the shell is pounded, it is only white chalk. The colouring in this and other cases is due to the way in which the light is reflected, from a film in the soap-bubble, from a finely layered or laminated texture in the pearl-oyster's shell, or from a delicate surface graining or cross-hatching in many other cases.

In the third place, the colouring of the animal may be due to a combination of pigmentary and structural (or physical) coloration; and this gives the finest display of all. We are familiar with it in the peacock's tail-feathers (really the "tail-coverts") and in many brilliant butterflies. There is an underlying pigment, the effect of which on the light that falls on the body is enhanced by the fine structure of the surface. In many cases the pigment is a simple brown, but the external sculpturing makes it like a living jewel. Often there may

result a bright colour, such as blue, which is not hinted at in the pigment. A bruising of the texture spoils the fineness of the colouring, and another feature is that the colour changes a little as the animal moves, or as we move, for different parts of the rainbow colouring reach our eye. This is familiar in many birds, with so-called "metallic" glimmer in their plumage. To sum up, coloration may be (1) pigmentary, as in the ruddy animal or the green plant; (2) structural, as in mother-of-pearl; and (3) a combination of the two, as in peacock's feathers.

Blood Pigments.—For several reasons we give the first place to the blood-pigments, such as the hæmoglobin of all the higher animals. The increase of vigour as we ascend the scale of life is partly due to the abundance of hæmoglobin and the use that is made of it, because, as we have said, it has the power of readily entering into a loose union with oxygen, captured in various ways, *e.g.*, on the internal surface of lungs, or on the external surface of gills. Man has some twenty-five billions of red-blood-corpuscles, which, if spread out, would cover a surface of over 3,000 square yards! Thus, taken together, the red-blood-corpuscles represent a very extensive internal surface for oxygen-capture. The mere possession of hæmoglobin, however, does not mean a high status in the scale of being, for the earthworm's hæmoglobin is much the same as ours. As far as we know, the first animals to produce or, so to speak, invent hæmoglobin were certain marine worms, known as ribbon-worms or nemertines; and this was one of the momentous steps in Organic Evolution. It opened the portal to higher life. Yet it must be noticed that among backboneless animals there are some other blood-pigments, similar to hæmoglobin, but not so effective. Thus hæmocyanin is common among crustaceans and molluscs.

Hæmoglobin has a very complex chemical composition, with a large molecule. It may be split into two parts, (1) colourless protein called *globin*, which varies greatly from one type to another, and (2) a constant coloured portion called *hæm*. This consists of four pyrrol rings linked together by an atom of iron—a pyrrol ring being C-C-C-C-N, four atoms of carbon united with one of nitrogen. There is a remarkable reason for mentioning this point, even in an elementary article, for the same pyrrol ring occurs in chlorophyll, the characteristic green pigment of plants.

There is a continual breaking down of hæmoglobin in the body, and some of the products almost certainly give rise to the

pigments of the bile in backboned animals, such as the green biliverdin. Other disintegration products of hæmoglobin or some related blood-pigment are deposited in the tissues of various backboneless animals, such as leeches and molluscs. It may be mentioned that the faintly bluish blood-pigment, called hæmocyanin, that is common in crustaceans and molluscs, has copper where hæmoglobin has iron.

Also related, because containing "hæm," are certain pigments called cytochromes (cell-pigments), that were discovered by Keilin in 1925, and are very widely distributed in plants as well as in animals. They seem to be concerned, not with carrying oxygen over a distance, as hæmoglobin does, but with its control at close quarters—within the cell. They occur from yeasts to flowering plants, from insects to Vertebrates—almost universally.

Chlorophyll Pigments.—Probably much older than the hæmoglobins are the chlorophylls of green plants, for on them the process of photosynthesis depends—the building-up of sugars and the like from carbon dioxide and soil-water. Something of this sort must have been achieved before there were very successful animals, for all ordinary animals require for their food the proteins, carbohydrates and fats that have been formed by green plants or by other animals. In saying that successful animals must have been preceded by green plants, we are not forgetting that there are a few simple animals, such as the green Bell-Animalcule (*Vorticella viridis*), that have chlorophyll of their own. These are not to be confused with various green worms, green sea-anemones, green freshwater sponges, and many green Protozoa (unicellular animals), which owe their colour to partner unicellular plants (Algæ) possessed of chlorophyll. We suggest as a scientific exercise the searching out of at least six quite different ways in which an animal or part of an animal may have a green colour.

The chlorophyll of plants is much more complicated than used to be supposed; it is, indeed, a system of four pigments. Two of these, chlorophyll-*a* and chlorophyll-*b*, are essential, for they absorb red and orange rays, thus appearing green; and in the sunlight there seems to be a continual cycle of changes, chlorophyll-*a* changing into chlorophyll-*b*, with absorption of carbon dioxide, and chlorophyll-*b* changing into chlorophyll-*a*, with liberation of oxygen for which we cannot be too thankful, for this is the origin of our breathable air.

The cycle between the two chlorophylls is of great interest, because in the blood of Vertebrates the red pigment shows the same general alternation—between hæmoglobin and oxy-hæmoglobin. Along with the two essential chlorophylls, there are two yellowish pigments, carotin and xanthophyll, which seem to be much less important and belong to a different group.

Chlorophyll proper, whether *a* or *b*, has a large molecule, which is readily split, by the action of an alkali, into two parts. One of these is a complex colourless alcohol called *phytol*. The other has for its foundation four pyrrol rings, each ring consisting of C-C-C-C-N, four atoms of carbon united by one of nitrogen. The four rings are linked together in the molecule, and associated with them in some way is a single atom of magnesium, so like the atom of iron in hæmoglobin. The resemblance of chlorophyll to hæmoglobin is very striking, and it may be that the former was a stage in the evolution of the latter. But the coloured part of chlorophyll is linked to an alcohol; that of hæmoglobin is linked to a protein.

Melanin Pigments.—This third group includes dark pigments, as in the negro's skin, the Polled Angus pelage, the crow's plumage, the choroid lining of the eye, the ink-bag of sepia and other cuttlefishes. There seem to be several different kinds, but melanins are difficult to purify, since they do not crystallize, and since they are very difficult to dissolve. They always occur in the form of minute granules. They may be on the surface, as in darkish birds and mammals; but most people must have noticed the densely black pigment on the lining of the body-cavity of many fishes and other animals.

As to the nature of melanins, there is strong evidence that they are derived from tyrosine, or from some related substance. Now tyrosine is one of the amino-acids, which have been called the building-stones of living matter. All living matter consists in essential part of proteins, and proteins are chains of amino-acids, the links of the chain breaking apart in some bodily changes, such as digestion, and being pieced together in others, as when the protein framework of a cell is repaired after wear and tear.

If pure tyrosine in a test tube is treated with an enzyme or ferment called tyrosinase, which is of wide occurrence in living creatures, it becomes, on exposure to air, first reddish and finally black; and this black pigment seems identical with naturally formed melanin. This is very interesting

because the ferment tyrosinase is common and the amino-acid tyrosine is common, so that we can understand that darkish pigments should be common.

Fatty Pigments.—The fourth group of pigments consists of "coloured fat-like bodies" (chromolipoids) or "fatty pigments" (lipochromes), the technical terms being preferable since the substances in question show no great resemblance to fats, save in their solubility in ether. They are widely distributed in plants and animals, and they are often of a yellow-orange-red colour. Two of them have already been mentioned, the "chlorophyll-yellows," carotin and xanthophyll, which occur in green plants along with the "chlorophyll-greens." Carotin is familiar in carrots, and it gives a yellowish colour to butter. The xanthophyll of many yellow flowers crops up again in the yolk of the bird's egg. The yellow fat of many animals, such as lizards, owes its colour to a lipochrome. Another good example is the reddish zoonerythrin (*zoon*, animal; *erythrin*, red), common in many of the crustaceans, such as shrimps, prawns, the Norway Lobster, and the Rock Lobster (Palinurus), which Victor Hugo called "the cardinal of the sea." Zoonerythrin is a widespread and cheerful pigment, occurring, for instance, in the red wattle above the eye of the grouse; and it is chemically next door to the carotin of carrots. The bluish colour of a living specimen of the Common Lobster (Homarus) is due to this same zoonerythrin, but in combination with a protein. When the protein is destroyed by heating, the free pigment takes on its familiar red colour, so conspicuous on the lobster exposed in the fishmonger's window.

Other Animal Pigments.—So far then, and it is no small gain, we see that the pigments of animals may be ranked in four groups: (1) the blood-pigments, *e.g.*, hæmoglobin; (2) the small group of chlorophyll-pigments, which are mostly restricted to plants; (3) the large group of melanins; and (4) the large group of lipochromes.

It would, however, be giving a false simplicity to the facts if we did not notice that there are many other animal-pigments that cannot be referred to any of these clearly-defined groups. Thus the wings of some yellow butterflies show pigments related to uric acid, and therefore to be regarded as of the nature of waste-products. The pigment of the Marbled-White Butterfly (Melanargia galatea) is chemically known as a "flavone," or "flavonol," and has been traced back to

Timothy or to Cocksfoot grass, on which the caterpillar feeds. Then there is the Tyrian purple secretion of the dog-whelk (Purpura) and some other sea-snails. It is the animal counterpart of indigo, just as the red pigment of the female cochineal insect is a distant counterpart of the alizarin of madder. The cochineal red is perhaps a reserve product; it is chemically a glucoside, yielding sugar when treated with dilute acid. But in an introductory survey it is probably enough to emphasize the four groups: the blood-pigments, the chlorophylls, the melanins and the lipochromes.

Uses of Pigments.—We must not embark on the large question of the uses of coloration—a fascinating question deserving treatment by itself. It is well known that some colours conceal their possessors very effectively, while others advertise their presence; some may attract or excite desired mates, while others may warn off intrusive enemies; and so forth—but let us leave this for future exploration.

The utility of a pigment is a different question from that of coloration, as is evident enough when we think of the cytochromes, which have practically no colour at all. Similarly, most people would say that a lobster's blood is colourless, though it has abundant hæmocyanin. A pigment may be of great physiological use though it has little or nothing in the way of colour; and a pigment, like the green of the bile, may be brightly coloured, although we cannot say that its colour, as colour, is of any use.

As to physiological uses, the first place must be given to the chlorophylls which make photosynthesis possible. Then come the blood pigments, such as the hæmoglobins and the cytochromes, which have to do with the distribution of oxygen in the body. It may be that some of the superficial melanins keep the glare of the sun from penetrating deeply into the body; and the absence of any pigment, as in the warm-blooded, snow-white ermine and ptarmigan, may lessen in winter the loss of the precious animal heat. In a few cases, a pigment may be a useful reserve. These must serve as illustrations; and we would close with the caution that while some animal pigments are of vital importance, others are waste-products or by-products, necessary in the normal chemical-routine or metabolism of the living body, but of no positive utility—unless we include pleasing man with their beauty!

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THE IMPROVEMENT OF ENGLISH CIDER

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ALTHOUGH not the oldest of English beverages, cider was certainly made in this country in early times and in very many parts of the country. The production predominated in the south-western Counties, but it also extended over Wiltshire, Hampshire, away into Sussex and Kent, and even penetrated northwards into Lincolnshire, Norfolk and Yorkshire.

Formerly cider (or—in the original spelling—sider) was made in the home for domestic consumption, and great were the qualities attributed to this drink—" which long experience hath taught do conduce very much to the constant health and long-lives of the inhabitants." The ordinary course amongst the lower class was to breakfast and sup with toast and sider through the whole of Lent, " which heighten their appetites, and create in them durable strength to labour. Sider was their physick also." This cider was very rough, often being made from the crabs and wildings of the hedgerows.

It was not until the end of the eighteenth century that the orchards proper began to be much planted. The Civil War with all the attendant troubles had passed by; continental wars prevailed for the most part, and, as foreign wines ceased to be imported, it became an object of national importance, and a patriotic duty, to encourage the home production of cider in every possible way. Squires and yeomen vied with each other in their effort to meet the national want, and the great English cider orchards of the south-west came into being. This was the golden age for cider and for cider-orchard culture. Even then, however, cider was of two kinds: a superior quality, made from the first brew, sold for use in the best establishments, and " ciderkin "—*i.e.*, weaker cider, made by the addition of water to the must as it was passed again through the mill. This " ciderkin " was given to the men in almost unlimited quantities during haytime and harvest and formed a wholesome and somewhat harmless drink. Quantities in excess of local demands were bought up by " cidermen " and sent in those days to London and Bristol, two great centres of trade; but the great part of this, it is said, went to the Continent and returned again to this country in the shape of cheap ports and sherries.

This prosperity of cider drew the attention of the Chancellor of the Exchequer, so that taxation was imposed, sometimes on

the orchard, but generally on its produce. Farmers much resented the visits of the supervisor who collected the dues; many orchards were uprooted and a decline commenced. With the cessation of the Napoleonic War, importation of foreign wine was resumed; wines with malt liquors proved formidable rivals, leading to a falling off in the demand for cider and a general decline in the interest taken in orcharding. The orchards were let down; the quality of the cider greatly deteriorated and this common rough cider came to be a drink only of the working classes.

Happily a reaction has now set in and cider—not the rough cider of the "eighties," but a high-quality beverage—has again become a favourite drink with people of all classes, and sales show an annual increase. It is perhaps impossible to indicate with strict accuracy the exact quantity that is made or sold for no returns are made, but duty was paid on cider from 1916–1922. The following figures for this give some measure of the quantities of cider sold during those years, although not entirely an accurate one, since farm-made cider was exempted from the duty, the quantities of this class are not indicated in the returns.

	Gallons
1916–17	4,218,960
1917–18	8,633,400
1918–19	8,035,200
1919–20	3,570,840
1920–21	5,070,000
1921–22	5,418,480
1922–23	6,596,220
	41,543,100
Average	5,934,728

No duty was paid after 1923, and no further figures are available, but those in the trade are of opinion that the sales of cider have now become considerably larger than the 6½ million gallons, on which duty was paid in 1922–23. Probably the quantity now sold is double this or nearly so.

How Present Supplies are Maintained.—The home supplies of cider distributed at present are, in the main, made (*a*) from home-grown apples; (*b*) from apples imported from France; (*c*) with cider imported from France. Before enlarging on the supplies from these sources, it is necessary to delve a little deeper into the cider question and consider which apples are most suitable for making cider. Of course the juice of every apple will make cider, but not all would be appreciated as a drink.

Apples for Cider Making.—Far back in the ages, cider makers had found out the kinds of apples that made the best cider. Such varieties as Kingston Black, Foxwhelp, Styres, Restreak, and Royal Wilding were famed; although generally it was found that beverages of the better class and flavour came from mixed varieties. Opinion was naturally hazy, however, as to what the best blend should be. This absence of exact knowledge gave the chance to the "sharp" men who devised all kinds of mysterious practices and sold "charms" for improving the cider brew.

The scientific work of the National Fruit and Cider Institute, since its establishment in 1903, whilst it has supported the use of blended juices, has done much to furnish the knowledge which justifies this practice. Thus, the modern view, framed as a result of this work, would seem to be that, for cider-making purposes, apples may be divided into three distinct classes, (*a*) the sharp or high acid group; (*b*) the sweet or low acid group; and (*c*) the bitter-sweets or varieties which, although low in acid, are rich in tannin. Relatively few apples have their contents of natural acidity and tannin balanced in the best proportions for the acidity and astringency desired in good cider, but that drawback is readily overcome by blending. Given sufficient fruit of each class, it is possible by blending to produce a cider of any desired standard of acidity and astringency.

The Supplies of Fruit.—*Cider Fruits.*—The orchards of the West, famous in olden days for cider apples, supplied large quantities of each class, and manufacturers could find sufficient quantities of each type. There were trees of Kingston Black, Tom Putt, Foxwhelp, etc., of the sharp class; Morgan Sweet, Improved Pound, Sweet Alford, etc., of the sweet class and Cherry and White Norman, Chissel Jersey, etc., of the bitter-sweet class, all giving juices that blended well to make the real vintage ciders. When the lean days came upon the cider industry, the orchards were either let down, or the trees were regrafted to other kinds. Where fresh trees were planted, these were not cider varieties but Blenheim Orange, Warner's King, Bramley's Seedling to give the grower the chance of selling his apples in the market for domestic use. As all these market apples belong to the high acid type, supplies of this class did not diminish but rather showed an actual increase, whilst the sweet class, and especially the bitter-sweet class, rapidly declined until an actual shortage has occurred.

That is why the present supplies of home-grown apples are unbalanced for cider making.

Culls of Market Fruits.—In the meanwhile, fruit growing of market varieties (culinary and dessert) had progressed rapidly in Kent, the Eastern Counties, Norfolk, the West Midlands and actually, also, in the cider counties of the South-West; and, as the "culls" from these market fruits became available for cider making, the supplies of the high-acid sorts were further increased.

There is thus an abundance of fruits of the "high acid" type which it may be difficult to utilize to the best advantage unless, also, adequate supplies of the bitter-sweet class are grown to effect a proper blend.

The culls of all cooking and dessert varieties and the high-acid apples will make a cider which is not properly balanced; it contains too much acid, has a rate of fermentation which is too rapid, and lacks body. When this thin cider is blended with that made from apples of the bitter-sweet class the want of balance is somewhat rectified.

The analysis figures given in the table below for ciders made (*a*) from blended cider varieties, (*b*) from Bramley's Seedling culls and (*c*) from a mixture of Bramley's and the bitter-sweet Dabinett show only too well the defect of cider made from Bramley's Seedling as compared with the blends. The high acidity of the Bramley's Seedling cider has been reduced from 0·84 to 0·5 of malic acid by the mixture of Dabinett, the tannin having been increased from 0·1 to 0·15 and the rate of fermentation lowered from 9·4 to 7·0. The figures for this blend show that the cider from the Dabinett and Bramley's Seedling is still inferior to that made from vintage cider fruits.

ANALYSIS OF CIDERS

(*The National Fruit and Cider Institute, Long Ashton, Bristol*, 1929)

Fruit used	*Final Sp. G.*	*Matic Ac*	*Tannin*	*Rate of fermentation*
(*a*) Mixed cider varieties	1·024	0·47	0·24	3·7
(*b*) Bramley's Seedling	1·020	0·84	0·10	9·4
(*c*) ½ Bramley's Seedling, ½ Dabinett	1·025	0·50	0·15	7·0

All the high-acid fruits, however, can be absorbed in the cider industry provided the industry can secure sufficient quantities of the bitter-sweet and sweet classes to blend with them to make the cider balanced and palatable.

The bitter-sweet apples are at present grown in large quantities in France, particularly in Normandy and Brittany,

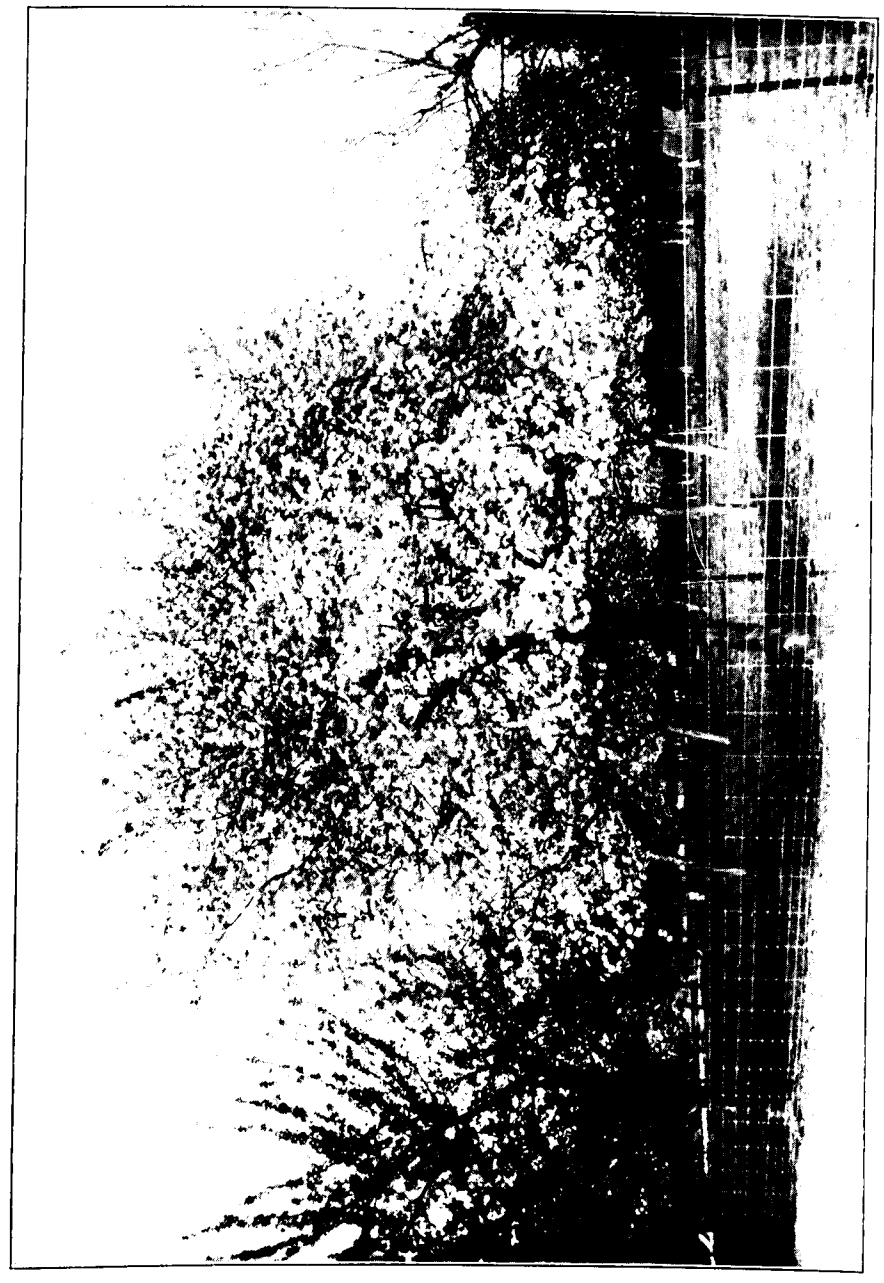

FIG. 1.—Sweet Alford apple tree (planted 1903-4) in full bloom. Note the dwarf, spreading habit of the tree.

THE IMPROVEMENT OF ENGLISH CIDER.

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FIG. 3.—Dabinett apple tree (planted 1903-4). A dwarf and spreading tree.

FIG. 2.—Knotted Kernel apple tree (planted 1903-4). A vigorous, upright-growing tree.

from which districts the English factories purchase large supplies, whenever France can spare them. This is by no means a satisfactory position either for the cider makers or for the English growers, for should the French crop run short the English cider makers are not able to obtain the full quantities of " bitter-sweets " and so cannot use as many of the English high-acid class as is desired. Statistics perhaps reveal the magnitude of the position rather well.

In 1925, the production of dessert and cooking apples in England and Wales was estimated to be 6,520,000 cwt. On an estimate, 10 per cent. of these will be " culls "—that is, 652,000 cwt. will be available for making cider. These " culls " cannot be used properly for cider-making unless there are available not less than 652,000 cwt. of " bitter-sweet apples " to mix with them. A number of bitter-sweet apples are grown in the south-west, but the quantity available is only sufficient for blending with the ordinary cider fruits, so few can be used for the market culls.

The English fruit growers outside the south-western counties have given little consideration, so far, to this matter, nor have they attempted to grow these " bitter-sweet " apples. There is every reason, however, for thinking that these " bitter-sweets " would grow just as well in other parts of England as they do in the south-west (or in France), and, perhaps, under the modern orcharding conditions practised in the fruit areas proper, might give even better crops.

It is realized that the fruit grower in Kent, Norfolk or the Isle of Ely may not wish to become a large grower of cider apples, or to have a whole range of varieties such as is found in the south-western orchards ; but each grower might find it desirable and profitable to grow just one or two varieties of the " bitter-sweets " to supply sufficient to blend with the " culls," of Bramley's Seedling, Worcester Pearmains, Lord Derby and Lane's Prince Albert—to enable all to be sold to the cider factory. Certainly, the cider factory would find it more convenient to be able to purchase all from one source than to purchase the high-acid fruits in England and the " bitter-sweets " in France. The research work done in recent years at the National Fruit and Cider Institute suggests that the three varieties known as Knotted Kernel, Dabinett and Sweet Alford are well suited. The Knotted Kernel is a large and vigorous grower which make a fine tree ; the Dabinett is less robust, although it comes into bearing at an earlier age. Both are reliable croppers and supply just the " bitter-sweet type "

of apple that is in demand by the cider industry. The Sweet Alford is a desirable sort of the "sweet type."

Detailed particulars of the three varieties are as follows :—

Knotted Kernel.—Bright Crimson apple, rather small. Good quality. Bitter-sweet. Very vigorous grower, upright, spreads with age. Generally rather late coming into bearing, then a heavy cropper.

Dabinett.—Green with a dull crimson cheek. Moderate grower, flat-headed. Heavy cropper.

Sweet Alford.—Pale primrose yellow, red cheek, medium size, a very good sweet variety. Strong grower, good cropper.

If fruit growers in all parts would provide just sufficient of these "bitter-sweet" and sweet apples to blend with their "cull" fruits, the cider factories and the cider makers should be able to purchase at home sufficient supplies of properly blended fruits as would enable them to make and sell a British vintage cider made wholly from British apples.

The National Fruit and Cider Institute, Long Ashton, Bristol, have promised to advise growers as to sources of trees or grafts of the varieties named, and sufficient quantities are available for all who care to plant.

* * * * * *

THE LIFE HISTORY OF BROCCOLI

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BROCCOLI is the name given during growth to winter hardy cauliflowers. It includes a number of very distinct strains, of which some yield the most valuable cauliflowers on the market. The plant is of considerable value as a field crop in the south-west of England, notably in the Mount's Bay area around Penzance, Cornwall, where it has been estimated as worth £100,000 annually to the district. It is also grown on a field scale in Kent and in other parts of the Kingdom.

The seeds cannot be distinguished even by the closest examination from other forms of cabbage, although they are much larger and browner in colour than turnip seeds. Curiously enough, a difference has been found between strains of Broccoli, the "Roscoff" strain possessing smaller and often darker seeds than the Cornish strains.

The seeds are generally sown along a headland on well cultivated ground in mid-April. During normal seasons, this allows sufficient time for the development of the young plants, but, in dry weather, germination and early growth may be seriously checked. The average time taken for germination is 14 days, and experiments conducted at this College indicate

that the extent of consolidation in the seed bed has a very profound influence upon the rapidity of germination. Under normal conditions, it was found that rolling the soil after sowing hastened the appearance of the seedlings by two days. Under dry conditions, the difference in the rate of germination as between a rolled and an unrolled seed bed is as great as ten days in favour of the rolled. Incidentally, it appears that the husk of a seed coat after germination remains underground or is carried up together with the seed leaves according to whether the soil is loose or fairly well consolidated. When the soil is loose, the husk is usually carried above ground with the seed-leaves, but, in consolidated soil, it remains below the surface. Fig. 1 shows, at the left hand of the top row, a plant that was grown in loose soil, whilst the others were in consolidated ground.

Seedling Stages.—The seedling in its earlier stages does not differ markedly from seedlings of closely related forms, such as those of cabbage and kale. It is not until the first foliage leaf has been produced between the two kidney-shaped seedling leaves that it acquires any distinctive appearance. At this stage, the leaves are of a much lighter colour than the corresponding leaves of other plants of the same family, whilst the edges of the third and fourth leaves are bluntly toothed. (Fig. 1, lower row.)

Where a valuable and limited stock of seed is available, the plants are often pricked off into beds on reaching this stage, each plant being allowed an area up to three square inches. Tests during the last two seasons show that this additional transplanting raises the average size of the plants at the time of maturity, and increases the proportion of first-grade marketing heads. The effect is due to the increased root system which develops when the plants are spaced at an early age; during a dry July the advantage is most remarkable, as the plants proceed almost without a check after the final transplanting. Between germination and the transplanting stage, growth appears to be slow, as the number of leaves does not usually rise above six; the older and smaller lower leaves, however, are being replaced by larger young leaves nearer the tip.

Transplanting.—By early June, the plants are ready for final transplanting, having reached the stage shown in Fig. 2. Experiments at this College have shown that the earlier in July the plants are moved into permanent quarters, the more uniform are the marketable heads. During the three months that follow midsummer, the greater part of the growth of leaves

and stem occurs, and it has been found that when the plants are not well rooted by the end of July, at least 10 per cent. of the plants fail to form a marketable head. In the Penzance district the time of transplanting is often limited by the date at which a preceding early potato crop can be cleared.

The specially rapid growth of leaves and stems during early autumn, and the formation of heads in spring, necessitate careful manuring. An application of dung is of the greatest importance, as it will encourage the formation of big well-rooted plants; a dressing varying from ten to fifty tons per acre is usually given. It is found that only well-rotted dung, ploughed into the soil at least a month before transplanting, leads to the steady growth that is desirable. It has also been found that a dressing of dung alone leads to the plants developing small heads and maturing later in the spring than otherwise. To counteract these tendencies, and to give the highest possible production of heads, superphosphate at the rate of 5 cwt. per acre has been found very successful. Bone meal at the same rate is also favoured by growers. Forms of potassic and nitrogenous manures are also frequently given and, under the appropriate conditions, undoubtedly lead to an increased yield. Kainit at about 6 cwt. per acre improves the colour and healthiness of the leaves and should be given with the phosphatic manure. A dressing would probably be well repaid on light soil or where broccoli follow a cereal crop on a mixed farm.

Nitrate of soda is very popular as a top dressing, and has been shown to accelerate growth in the last two months where the plants are small and the leaves pale coloured. On no account, however, should nitrogenous manures be applied to areas when it is intended to save the plants for seed, as a reduction of as much as 50 per cent. in the yield of seed may result.

Early Differences between Strains.—Differences in type between different strains are first visible at Michaelmas. Plants of most of the old Cornish strains show a long and strong stem, with the leaves fairly loosely arranged and with a coarse curly edge. Plants of the so-called Roscoff strains, on the other hand, show a shorter, stouter and more tapering stem, with the leaves more compactly arranged. A typical Roscoff plant at this stage rather resembles a half open rose, all the leaves being slightly cup-shaped. There is a third distinct type marked by light bluish-green leaves, which are very blunt tipped and erect in position. This type was, unfortunately, very abundant in the thirteen commercial "Roscoff" strains

FIG. 1. The upper row shows seedlings immediately after germination. The left-hand plant was germinated in loose soil. The lower row shows plants ready to be pricked out.

FIG. 2. Plants ready for transplanting. Note large root systems due to pricking out when younger.

LIFE HISTORY OF THE BROCCOLI.

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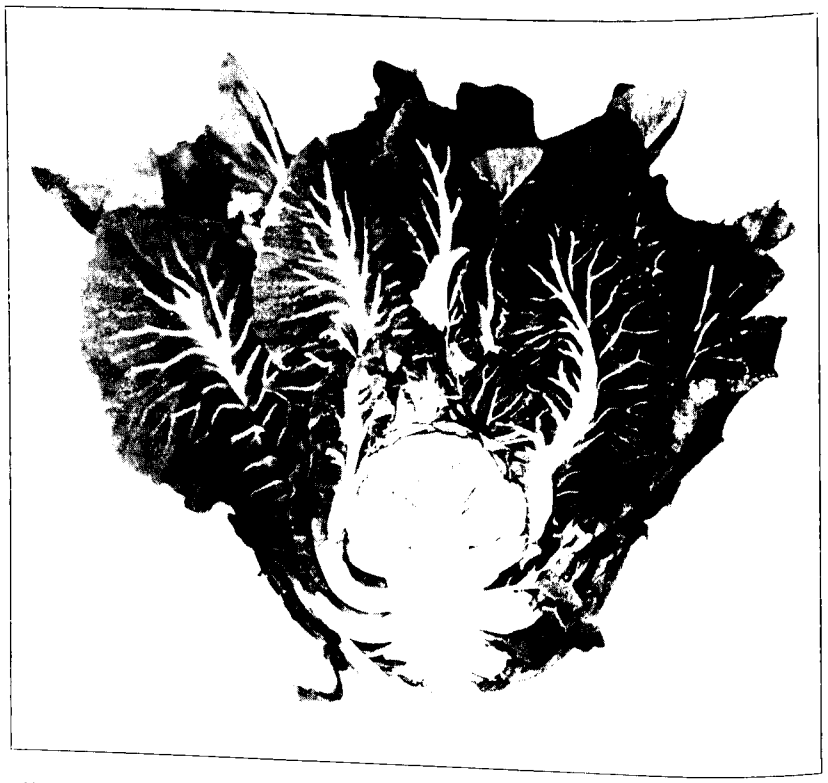

FIG. 3. A Roscoff plant of "late" type ready for cutting for the English market, showing head and leaf characters (inner leaves only focussed).

FIG. 4. Three branches from one plant with equal numbers of flowers. A (left hand) cross-pollinated by hand; B (centre) self-pollinated; C (right hand) naturally cross-pollinated.

under trial during the season 1929–30, and is generally known as the Angers type. The plants mature fairly early and give a loose, generally yellowish-white head with closely twisted leaves.

Besides the differences between strains of different origin, it has been found at this College, in testing the commercial stocks of seed, that early and late strains show different characteristics by the end of September.

The predominant type of plant in late strains is usually larger and has more numerous leaves, while individual leaves are dark green with white veins. They are also often slightly curly along the edge, and have a pointed tip. The commonest type of plant in the early strains is more compact, and the leaves tend to show a rather grey-green surface and to be blunt at the tip. The plant shown in Fig. 3 is distinctly of the late type.

The Roscoff strains show many distinct types of plants, and it is hoped to obtain a really good "first early" and a "dead late" strain of Roscoff broccoli, just as there are now Cornish strains for these difficult periods of marketing. At present the various strains of Roscoff mature during the "mid-season" period in February and early March, although some are claimed to be "early" strains.

The Head of Flowers.—Growth is checked when the maximum day temperature drops below about 50° F., but development inside the head continues slowly. By early November in the early strains, and by the end of December in the late strains, the malformed heads may be seen by cutting away the leaves.

The "head" which is later to be marketed is formed by a very early production of flower buds from the tip of the main stem and the branch stems below. It appears that growth in the broccoli is diverted from leaf to flower development at just about half the age at which this occurs in the cabbage. A cabbage usually shows no sign of flower production before it is a year old, but the broccoli at six months has a stem in which elongation is suspended, but development proceeds apace.

Observation has shown that side branches are produced in order from below upwards, but so well regulated is the rate of growth that, in a first class cauliflower, all these branches are kept with their tips together making a hemispherical dome. Moreover, in the best heads, it appears that all the side branches arise from almost the same level, giving the head the appearance of an umbrella when cut downwards into two halves (Fig. 3).

The spherical heads produced in this way are the most

attractive in appearance and are the more easily packed and transported. This character of producing spherical heads is of great economic importance in deciding the value of a broccoli strain, and it is interesting to note that it is to be found in some individuals of the best old Cornish strains although it is characteristic chiefly of the Roscoff strains.

The Marketing Stage.—The side branches, on growing into an umbrella-like formation, are seen to be covered by irregular white discs at the tops, which are closely packed to form a hemispherical covering. This is the edible portion and it is composed of approximately two to three thousand flower buds. Even at this early stage, a stalk and four very fleshy sepals in each flower can be discerned by the use of a microscope, but the other parts are undeveloped. Two conditions help to decide the value of the plant at this stage—regularity of growth and protection of the head.

If the flower buds are uniform in size, and are all developed at the same height, the marketable head has a distinct and regular grain and it is said to show a good "curd." The so-called woolly heads are those in which the individual flower buds are irregular instead of spherical in shape.

The colour of the flower buds and, consequently, the cauliflower head, is much affected by exposure to climatic conditions, being dead white where well protected, and a dark buff colour where freely exposed. Protection is given by the innermost leaves, which are incurved and sometimes slightly twisted in good plants. The late plant photographed in Fig. 3 is fairly well protected, and very little of the four-inch head is to be seen from above. In a good plant the head may reach a diameter of six inches without being visible until the leaves are removed.

In exposed positions, such as the botanical grounds at the Seale-Hayne College, it has been found that protection of the base of the head by the bases of the outer leaves is also very important. Where the outer leaves are not "feathered" to their base, but show a distinct stalk, the head is liable either to be mottled in colour, owing to the action of rain, or softened by frost. Attention is therefore being paid to the width of the outer leaves at their bases in selecting the best plants for breeding.

It is largely due to their perfect whiteness that all the better strains of broccoli give the best cauliflowers that come on to the market during the year. They surpass in shape, colour and general appearance the autumn-maturing cauliflowers, which are mainly raised from Italian seed. To avoid confusion, there is much to be said in favour of including the winter-hardy

cauliflowers or broccoli under the term "cauliflower," even whilst growing, as they are always marketed under this name.

The exact stage of cutting varies with the requirements of the markets. For the English markets, a diameter of four inches is generally most popular, but for the continental markets the head is allowed to become fully six inches across. The time required for this increase in size is only from about three to eight days, depending upon the temperature.

Pollination.—The head grows rapidly to a diameter of about eight inches, after which it begins to break because the individual branches then elongate irregularly. After this stage the head is very liable to damage by frost and, with the earliest strains, sometimes the entire crop of seed is lost through a frosty spring. Experiments are being carried out at the College to determine the best method of checking development after the marketing stage is reached, so that the tender branches are not exposed until the hardest frosts are over. One promising method appears to be that of moving the plants directly into a shaded, but frost-protected area—such as the headland below a well-grown hedge. Another is to lift the plants and to store them in a cool building, with a good spadeful of earth secured round the roots by a sack, until the weather is milder. The former method entails less risk to the plants, and less labour, but does not suspend growth so effectively as the latter method.

Stems rapidly develop to a length of two feet or more, giving the plant a shrub-like appearance, and the flowers then begin to develop. Many flower buds are aborted, but others become green and develop into typical yellow cabbage flowers. Between 500 and 1,000 flowers are generally produced at the height of flowering, which may be at any time between late May and early July. It has been found at this College that the order at flowering does not follow closely the order at marketing time, and considerable overlapping occurs between early and late strains. Where seed is being saved from plants of both strains in close proximity, very considerable inter-crossing occurs with consequent loss to both strains.

Honey bees are the most active carriers of pollen, but humble bees often take part. Both bees will seek broccoli flowers from a distance, and observation has shown that each flower is usually visited twice or three times by bees. It is the earliest visit that normally leads to fertilization as the stigma is exposed at an early stage and is in a very prominent position. Later visits lead to pollen being removed from the bursting stamens and left on other flowers.

Cross-fertilization is the most usual natural method of reproduction, and not only will pollen from different types of broccoli serve the purpose, but also pollen from any flowering cabbage, sprout, kale, etc., and sometimes even from turnips. Few plants when first self-pollinated will give uniform progeny, on account of the perpetual inter-crossing that has occurred in previous generations, and it has been found impracticable to self-pollinate twice in successive generations of broccoli owing to the considerable loss of vigour that has resulted.

The establishment of a valuable strain in such a plant must depend chiefly upon the breeder's power to select two plants of similar genetical constitution as parents for the strain, so that a type both desirable and uniform can be obtained.

Seed Production.—Two months after pollination, the seed is generally ready for harvesting, and the entire plant, or branches of the plant, are removed for final drying in a shed. A fair yield from a normally cross-pollinated plant is between one and two ounces of seed, though very early strains rarely give more than one ounce per plant. Under self-pollination anything from 0 to 10,000 seeds may be obtained per plant; individuals vary very much in their power to produce seeds under this treatment.

Fig. 4 shows three branches with the seed set under different treatments. The right hand branch (C) was exposed to natural cross-pollination; branch (A) was carefully pollinated with pollen from another plant; whilst the middle branch (B) was carefully self-pollinated. It will be noticed that self-pollination in this case only provided a single seed, whilst natural cross-pollination produced the most.

It is interesting to note the strong tendency of natural forces to encourage the development of plants that are mediocre in the time of maturing and in type. Valuable early and late strains of broccoli tend to be lost by intercrossing with the mid-season strains, and particularly good types of plants do not produce equally valuable offspring on account of the influence of less valuable types during pollination. The production of well-defined and valuable commercial types, and the preservation of these by carefully regulated breeding, is, therefore, of great importance to the industry.

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WEEDS OF GRASS LAND—III *

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General Methods making for Improvement (continued).—*Grazing.*—The great influence of judicious grazing on grass land is widely recognized, but it is essential to bear in mind that grazing will be most effective in bringing about improvement when it is associated with other factors already mentioned or to be discussed below. It is generally accepted that grazing is at its best when it involves the use of mixed stock, or different classes of stock following one another. Grazing by horses alone is notoriously a bad practice, since these animals are rather fastidious in their choice, taking only the best of the herbage. Cattle are much less selective, but will avoid the roughest material as long as better grazing is plentiful; but it is wonderful what a lot of roughage a bunch of hungry cattle will clear up in the autumn. Sheep graze very closely, and will often consume weeds that other stock reject. At the same time they are more selective than cattle, and, as Stapledon and Hanley put it,† "the introduction of cattle is the best corrective for the ill effects of horse or sheep grazing." When it is possible it is best to graze with more than one class of stock, say horses and dairy cows, followed perhaps by store cattle, and finally dry ewes. Close grazing with sheep has long been practised for the purpose of reducing certain troublesome weeds, such as yellow rattle and ragwort.

To ensure even growth of good herbage it is essential that all grazing land that gets rough should have the mower run over it in late summer, in order to prevent the accumulation of coarse tufts of unpalatable grasses. If stocking is sufficient, subsequent growth will not be patchy and coarse. Droppings should be distributed by harrowing, or the development of ugly patches that stock refuse to touch will certainly occur to the detriment of the pasture.

The recently-introduced practice of frequent manurial treatment associated with sectional and close grazing, in special cases where pasture is limited, is calculated to lead to a real reduction of the weed flora.

Salting.—Just how far salting of pastures makes for a reduction of weeds generally is not clear, but many farmers regard it as a useful means of improvement. Apart from any

* Previous articles appeared in the issues of this JOURNAL for December, 1930, p. 871, and January, 1931, p. 985.

† R. G. Stapledon and J. A. Hanley, *Grass Land*, 1927.

possible inhibitive action it may have upon individual weeds, such as yellow rattle, an application of 4 to 6 cwt. of salt is believed by some farmers to make the pasture more attractive to stock, which therefore graze and tread it more closely and thoroughly.

Cutting Individual Species.—Early mowing as a means of reducing annuals has already been mentioned; it may be added here that some species of grassland weeds must receive individual attention. Among these species are thistles, hardhead or black knapweed, ragwort, ox-eye daisy, tufted hairgrass or "bull pates," dyer's greenweed, rest harrow, rushes and sedges and other perennials. These must all be cut over, sometimes more than once, and on small areas some of them may be most satisfactorily dealt with by hand pulling.

Clean Seeds.—Finally, it may be well to emphasize the importance of using only clean seeds when laying down land to temporary or permanent grass, or when sowing renovating mixtures. The sowing of impure seeds is a ready means of introducing weeds to a farm. In this connexion it is a bad practice to give poor weedy hay to stock on pastures, or to scatter hay-loft sweepings on grass land with the intention of helping it to fill up: such action is likely to lead to the introduction of many docks. It is desirable to take the greatest possible pains to ensure a clean pasture to start with, and thereafter care should be taken so to manage the pasture that "weeds"—worthless grasses and other plants—shall be kept down. Nearly 170 years ago Stillingfleet wrote:*

"If a farmer wants to lay down his land to grass, what does he do? he either takes his seeds indiscriminately from his own foul hayrick, or sends to his next neighbour for a supply. . . . By this means . . . a certain mixture of all sorts of rubbish . . . must neccessarily happen.

"Some say then, that if you manure your ground properly, good grasses will come of themselves. I own they will. But the question is how long it will be before that happens, and why be at the expence of sowing what you must afterwards try to kill by manuring? which must be the case, as long as people sow all kinds of rubbish under the name of hay seeds."

Stillingfleet's indictment of farmers for sowing bad seed is fortunately not applicable at the present day, but his implication of the effect of manuring is still true. As he suggests, however, it is unwise to commence with a bad weedy pasture, on which much labour must be expended to get it into good condition.

Summary.—Among the general methods that will make for improvement have been mentioned drainage, liming, manurial

* Benjamin Stillingfleet. "Observations on Grasses," pp. 365, 366, *Miscellaneous Tracts Relating to Natural History, Husbandry and Physick.* 2nd Edition. 1762.

FIG. 1. MOUSE-EAR CHICKWEED (*Cerastium vulgatum* L.).

a, Seeds, natural size and × 15; *b*, early stage of seedling × 1; *b'*, surface view of cotyledons; *c*, second stage of seedling × 1; *d*, third stage of seedling × 1; *e*, flowering portion × 1.

WEEDS OF GRASS LAND.

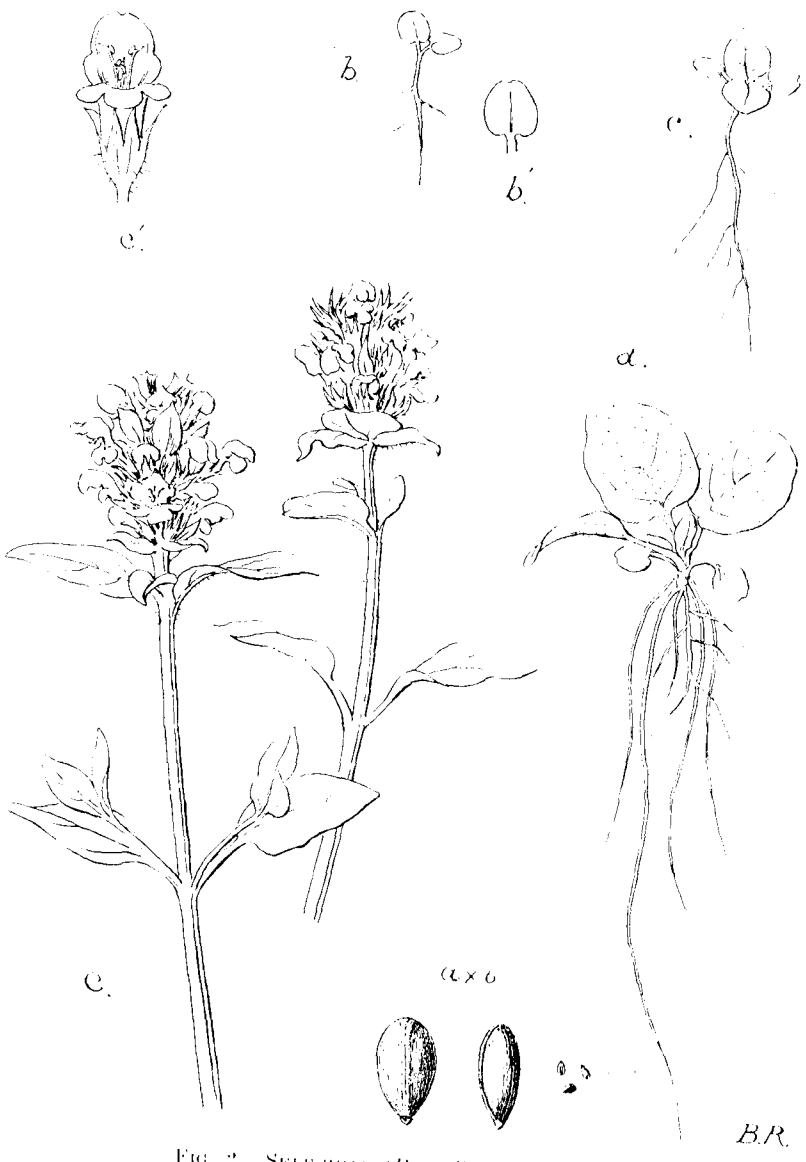

FIG. 2. SELF-HEAL (*Prunella vulgaris* L.).

a, Seeds, natural size and × 6; *b*, first stage of seedling; *b*¹, surface view of cotyledon; *c*, second stage of seedling; *d*, third stage of seedling; *e*, flowering stem (*b*, *c*, *d* and *e*, natural size); *e*¹, flower (enlarged).

FIG. 3. RIBWORT PLANTAIN OR RIB-GRASS (*Plantago lanceolata* L.).

a, Seeds, natural size and × 5; *b*, *c*, and *d*, first, second and third stages of seedling × 1; *e*, flowering plant × ½; *e*¹, flower (enlarged).

FIG. 4. BROAD-LEAVED PLANTAIN (*Plantago major* L.).

a, Seeds, natural size and × 10; *b*, *c* and *d*, first, second and third stages of seedling × 1; *e*, flowering plant × 2/3; *e'*, flower × 4.

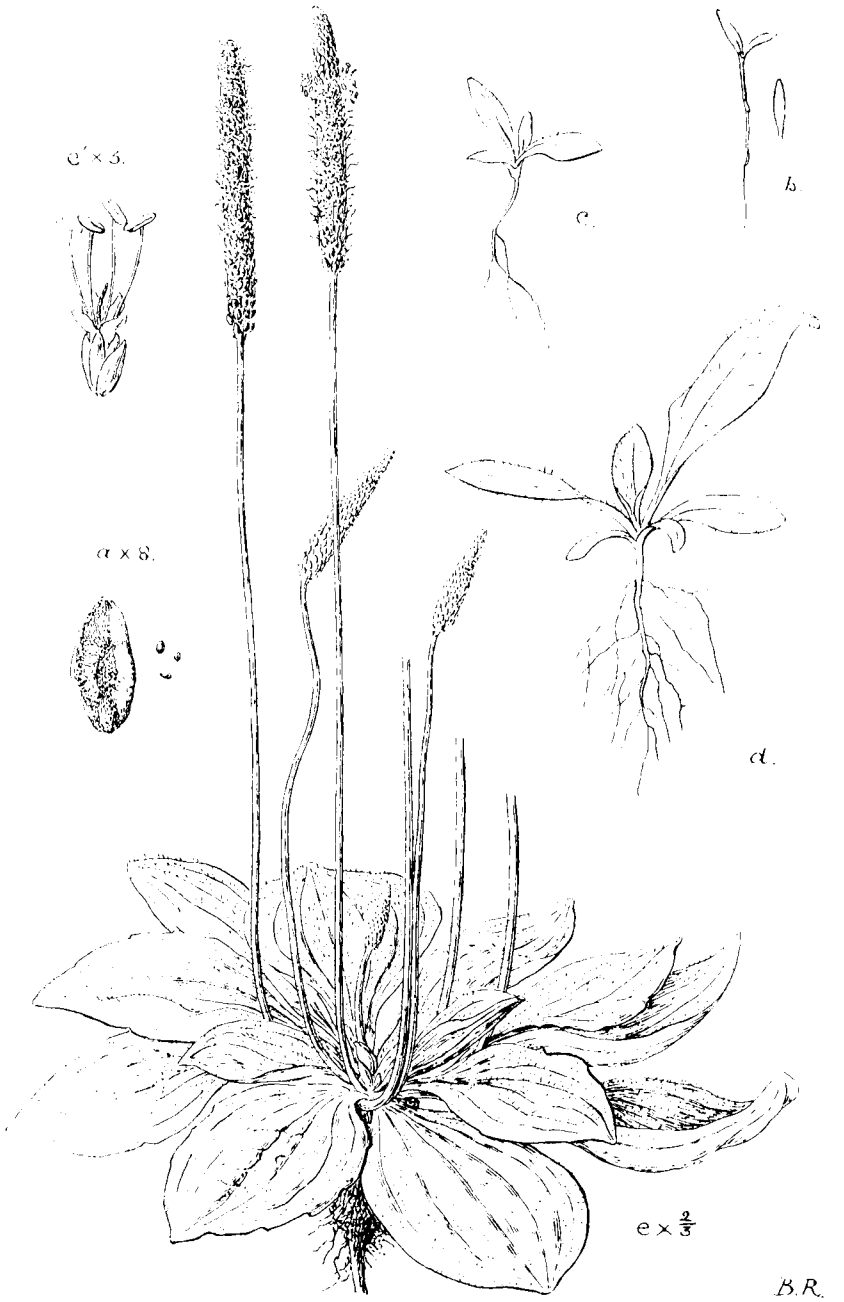

FIG. 5. HOARY PLANTAIN (*Plantago media* L.).

a, Seeds, natural size and × 8; *b*, *c* and *d*, first, second and third stages of seedling (natural size); *e*, flowering plant × 2/3; *e'*, flower × 3.

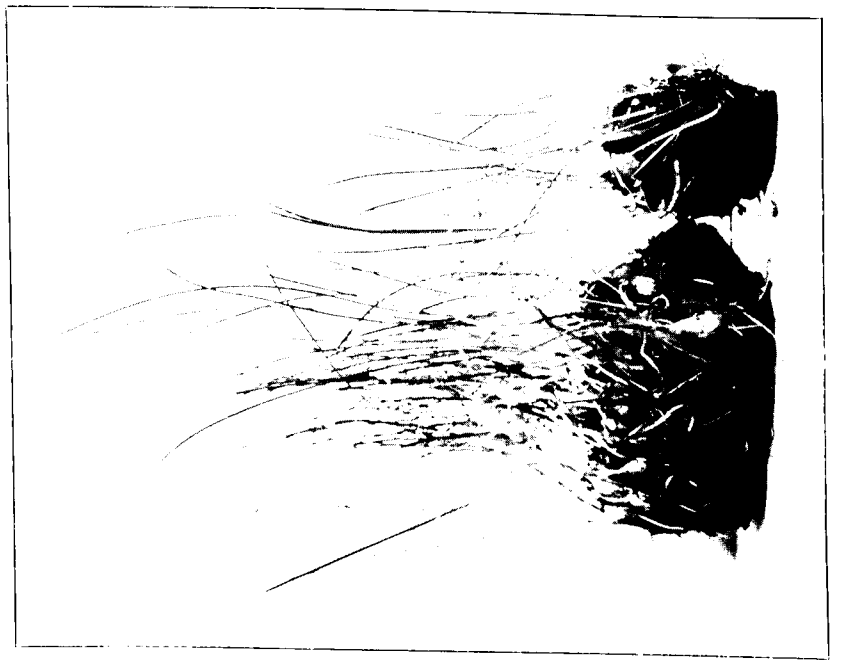

FIG. 7. WILD ONION (*Allium vineale* L.)
The plant in the young state, winter and early spring

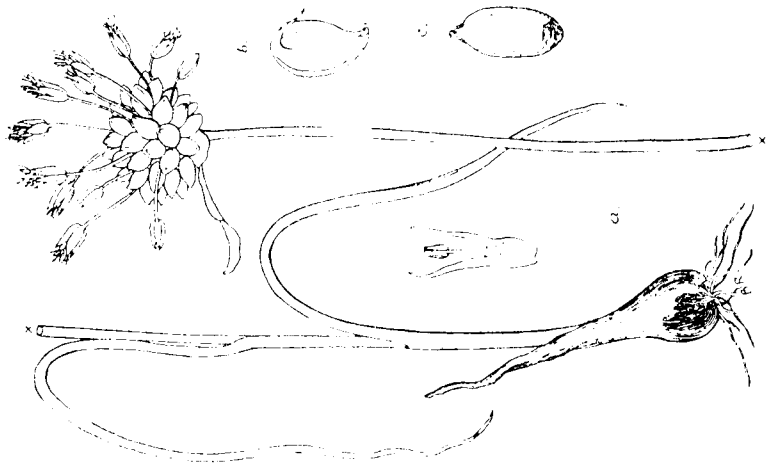

FIG. 6. WILD ONION (*Allium vineale* L.).
a, Bulb and flowering stem (reduced); *b*, aerial bulblet, and *c*, wheat grain (slightly enlarged).

FIG. 8. RAMSONS OR BROAD-LEAVED GARLIC (*Allium ursinum* L.).
a, Seed, natural size and × 5; *b*, *c* and *d*, first, second and third stages of seedling (natural size); *e*, flowering head and leaf (natural size).

FIG. 9. THE BURDOCK (*Arctium lappa* L.).
a, Seeds natural size and × 2½; *b*, *c* and *d*, first, second and third stages of seedling × 1; *e*, flowering portion × ⅓; *e*¹, flower, enlarged.

treatment, harrowing or mechanical treatment, clearing scrub and bushes, sowing of wild white clover, mowing tufts and roughage, early mowing of grass for hay, cutting surplus grass for hay or silage, consolidation, grazing, salting, cutting of individual species, sowing clean seeds.

An attempt may now usefully be made to deal individually with a few of the worst weeds of grass land. Only a limited number of representative species, however, can be considered in these articles ; it is hoped later to issue a Bulletin containing these articles together with notes on other species of grassland weeds.

It may be noted at the outset that the Natural Orders contributing the largest numbers of weeds are the *Ranunculaceæ*, *Cruciferæ*, *Caryophyllaceæ*, *Rosaceæ*, *Umbelliferæ*, and *Compositæ*, the last named being especially prolific in weeds of a harmful character.

Lady's Smock (*Cardamine pratensis* L.), known also as Cuckoo Flower or Bitter Cress, is a common and well-known perennial flower of damp, low-lying meadows and pastures. It is about a foot high, with pinnate leaves ; the conspicuous flowers are about 1 in. across, lilac in colour, and, like other crucifers, the four petals are arranged in the form of a cross. The flowers appear from April to June.

This species is hardly of great economic importance, but it is an " indicator " plant, and may sometimes occur in quantity. The general methods applicable for the improvement of land of the type on which it is common—drainage, liming, judicious manuring and grazing—will certainly diminish it.

Mouse-ear Chickweed (*Cerastium vulgatum* L.) is a frequent and prolific weed of meadows and pastures, and may occur on almost any kind of soil. It is usually perennial, and is a slender, straggly, procumbent, downy plant (Fig. 1), with small oblong-lanceolate leaves placed opposite each other in pairs on the stem ; its clusters of small white flowers are arranged on short stalks, and appear from April to August. Owing to its lowly habit, it is often difficult to determine just how serious its presence may be, but it occurs in plenty all over the country. It has been already stated that this weed was found 49 times in 80 turves in Dr. Fream's investigations. It is to be found on grass land generally, but more especially upon poor and unimproved land in need of good treatment. The weed frequently occurs in patches, which should be mown close with the scythe before seeding takes place, and

better grasses and clovers should be encouraged by manuring and close grazing. The seeds of mouse-ear chickweed may occur in samples of white clover and alsike seed, and in samples of grass seeds.

Self-heal (*Prunella vulgaris* L.) is sometimes very troublesome in poor pastures and meadows. It is a somewhat hairy perennial, 6 to 12 in. high, with a square stem, and almost oblong opposite leaves, the lower pairs of which are stalked and the upper sessile. The plant has a creeping rootstock. The small, reddish-purple, two-lipped flowers occur in whorls in dense terminal heads (Fig. 2), and open from July to September. Samples of impure clover seeds are apt to contain the almost egg-shaped seeds of self-heal, so that care should be taken to ensure pure seeds for sowing.

This plant occurs naturally in damp grass land, and is held to indicate poor, sterile soil; in Scotland it is known by the name "Blaw-weary." Close grazing with sheep, and sound judicious manurial treatment, will effect an improvement in the herbage and a reduction in the weed. On heavy land basic slag is useful in checking it, and on light soils superphosphate.

The Common Bugle (*Ajuga reptans* L.), another perennial, is somewhat similar to self-heal, but more handsome if equally lowly. The stems are 6 to 12 in. high, and the leaves sessile and ovate. The blue flowers are arranged in loose whorls in longish spikes (2 to 8 in. long). They open from May to July. The plant, which is common by roadsides and in medium to poor grass land, is spread by seed and by stolons or runners. It may be reduced in the same way as self-heal.

The Common Daisy (*Bellis perennis* L.) or "Day's Eye," is too well known to need description here. It occurs on almost all soils in poor pastures and meadows, and on lawns, flowering almost all the year round. The rosettes of leaves lying flat on the ground prevent the growth of grasses and clovers, as may at once be seen on cutting off a daisy plant below the crown and removing it, a bare patch being left. It is sometimes present in such excessive quantity in pastures that much loss of good herbage occurs. The best plan of dealing with this weed is to encourage clovers and better grasses by manurial treatment, thus smothering it out by taller and more useful herbage. Fertilizers should include sulphate of ammonia, which may be expected to have a very

beneficial result. Close grazing with cattle and sheep should follow.

Plantains (*Plantago* spp.) are well known to most farmers and gardeners. Three species are very troublesome in grass land:—

The Ribwort Plantain or Rib-grass (*P. lanceolata* L.) is a perennial, having narrow, ribbed, more or less lanceolate leaves, 3 to 12 in. long; tapering rootstock; and short, globose or cylindrical heads at the end of long, angular stalks (Fig. 3). Flowering takes place between May and October. This plantain is known to children under the name of "Cocks and Hens." The brown, shiny seeds somewhat resemble very small date stones, and, although less plentiful, perhaps, than formerly, they are still one of the most common impurities in many kinds of clover and grass seeds. In America this species is known as Buckhorn.

The Broad-leaved Plantain (*P. major* L.), also termed Greater Plantain or Way-bread, is a perennial, having broadly-oblong ribbed leaves on long channelled stalks; a stout truncate rootstock; and minute flowers in very long, slender spikes (Fig. 4). These spikes, when in fruit, are often given to cage birds, which greatly relish them. The writer has by him a spike measuring 19 in. at the end of a stalk 4 in. in length. Flowering occurs between May and September.

The Hoary Plantain or Lamb's Tongue (*P. media* L.) is another perennial, having downy, sub-sessile, broadly elliptical ribbed leaves, with short, flat stalks, the leaves lying very close to the ground (in the two former species the leaves are rather ascending) and destroying all vegetation beneath, leaving a bare patch if the plant be removed. The rootstock is tapering, and the flowers are packed in a close cylindrical spike, shorter than in *P. major*, but on a longer footstalk or stem. The flowers are fragrant, and somewhat conspicuous owing to the lilac bracts; they appear from June to October (Fig. 5).

These three plantains are perennial, and all are common in grass land on practically all soils, although *P. media* is perhaps more frequent on dry calcareous soils. They are a very common trouble in lawns. Where these weeds are very plentiful on a small area they may be spudded out, or be removed with the docking iron, before proceeding to give manurial treatment and arrange close grazing. Rib-grass is frequently included in grass mixtures, perhaps because it will

do well on poor uplands, where in the young stage it may be useful for sheep, and possibly because the roots open up the soil to air and moisture. On the better soils it should not be used for this purpose. Pure seed, free from the seed of plantains, should invariably be sown for leys and permanent pasture.

The general measures recommended for the improvement of grass land should quickly reduce these weeds.

The Wild Onion or Crow Garlic (*Allium vineale* L.) has already received attention in Miscellaneous Publication No. 61 (*Weeds of Arable Land*), in which its life history is fully discussed. The weed also occurs in grass land, where it usurps the place of better herbage, and is otherwise very harmful because it is apt to taint the milk of cows that may be at pasture, and also the butter produced from such milk. On a dairy farm, indeed, a pasture may be rendered almost useless for milking cows owing to the wild onion. It may also badly taint the meat from stock that consume it, unless they are removed to a free pasture for a week or two before slaughter. Sutton says* that the onion-like leaves appear to be very tempting to milch cows, and that "persistent hand-pulling of the bulbous roots early in the year is the only way of ridding pastures of crow garlic." Experiments at Woburn showed that "when the stem is thrown up it is almost impossible to pull the stem and bulb up together. But, as the season advances, the bulb seems to work up to the surface, and about June it is quite easy to pull up stem and bulb together" (Figs. 6 and 7).

This weed is only reduced with the greatest difficulty. Its presence in excessive quantity over a small area may render it advisable to pare and burn the surface soil containing the bulbs, and then re-seed the patches. On a large area it may be best to plough out, take two thoroughly hoed root crops, and re-sow with a heavy grass mixture on the "Elliot" system, which may help to smother the weed. Spraying with a 5 per cent. solution of carbolic acid was long since found at Woburn to reduce the weed, but it is not proved that this treatment is really effective.† When a field is badly infested it may be necessary to consider whether the drainage is effective, and whether a full course of improvement should not be started. Persistent hand-pulling, or even repeated mowing, between spring and autumn, should greatly help to reduce

* Martin J. Sutton: *Permanent and Temporary Pastures*, 1929, p. 145.
† *Jour. Roy. Agric. Soc.*, 1900, 1901 and 1902.

this pernicious weed. Milch cows should not be allowed on the pasture, which should be given up to horses, young stock, fattening beasts and sheep; but care should be taken to change the pasture a fortnight before stock are sold for slaughter.

Ramsons or Broad-leaved Garlic (*Allium ursinum* L.) is a fairly common plant on moist, shady spots, in pastures, as by the sides of streams (Fig. 8). It is 1 to 2 ft. high, with large, flat, broad leaves, resembling those of the lily-of-the-valley. The stems are triangular, and bear a flat-topped umbel of white flowers, which appear in May and June. If crushed, the whole plant emits a strong characteristic smell of garlic. Ramsons is chiefly troublesome where milch cows may eat it, as they frequently do, when the offensive odour and taste characteristic of the plant is communicated to the milk and the dairy produce prepared from it. There is also the danger of meat being tainted. The weed is not likely to occur on extensive areas, and where cattle may get at it the plants should be cut down regularly or the bulbs may be dug out. Temporary change of pasture as may be necessary is also indicated.

Meadow-sweet, Queen of the Meadow (*Spiræa ulmaria* L.), is a tall, handsome perennial, attaining to 4 ft. in height; it sometimes occurs very freely in low-lying, damp meadow land, such as water meadows. Meadow-sweet is herbaceous, with large leaves upwards of a foot long from the base of the plant, interruptedly pinnate, with serrate edges, and white and downy beneath. The flowers, which appear between June and August, are collected in large compound cymes 2 to 6 in. in diameter; each single flower is small, about ¼ in. in diameter, white or nearly so, and sweetly fragrant. This species is a favourite among wild plants, is reminiscent of the garden spiræa, and in view of its stately beauty is aptly named Queen of the Meadow.

The only plan of getting rid of an excessive quantity of this tall, stout plant is to mow it regularly, and by drainage, liming, manurial treatment and grazing to encourage more useful herbage, when the weed should soon be much reduced or gradually disappear under progressive improvement of the land.

The Burdock (*Arctium lappa* L.) is an erect branched biennial, often 3 to 4 ft. high, that grows chiefly in waste places, by hedges and ditches, and in damp grass land on calcareous and

clay soils. It has a very stout stem, and large alternate, stalked, heart-shaped and pointed leaves, usually very cottony beneath and frequently a foot long. The roots are strong and deep seated. The small purple flowers appear in July and August, grouped together into globose heads each about 1 in. in diameter; the heads have stiff, spiny, hooked bracts, and readily adhere to the clothing of man or the fur and hair of animals, thus securing their distribution. The name *Arctium* is derived from the Greek *arktos*, a bear, from the rough heads or "burs."

The Burdock (Fig. 9) is spread by seeds, and should therefore be attacked by regular cutting early in the summer as soon as the plants begin to show up well, to prevent seeding. Where it is known to occur the first-year plants, which merely consist of the roots and a large rosette of leaves, should be thoroughly spudded and grubbed out, cutting them off well below the crown. Need for general improvement is indicated if the burdock is plentiful.

The Butter-bur (*Petasites vulgaris* Desf.) is a large, strong-growing perennial that commonly occurs in damp, wet meadows, in low-lying land near streams and rivers, especially on sandy and clayey soils, where it is on occasion a serious pest. It has been described as "the largest, and, where it abounds, the most pernicious of all the weeds which this country produces" (Johns).

The butter-bur has an extensively creeping, fleshy rootstock from which flowering stems are sent up during the early spring months (February to May) before the leaves appear. The flowers are pinkish or dull lilac, in head-like panicles on a short, fleshy stalk. The male and female flowers are usually in different heads. As in the case of coltsfoot, the leaves follow the flowers; they are very large—up to 3 ft. across—resembling those of rhubarb, and borne on long stalks; they are white and cottony beneath. The common name is said to have been derived from the fact that the large leaves were formerly used for the purpose of wrapping up butter, but there are no "burs" on the plant.

This weed must be attacked by cutting down the flowering stems to prevent seeding, and later by persistent cutting of the large leaves to prevent the manufacture and storage of food for the future use of the plants. Cut surfaces after spudding might be treated with a pinch of sulphate of ammonia, sulphate of iron, or sulphate of copper (bluestone). Very small

patches may be grubbed out, but as the root system is extensive and deep seated, this plan is too costly on large areas. Spraying with a 5 per cent. solution of copper sulphate might be tried, as the leaves are so large and rough they would be likely to retain the liquid, but cutting is probably simpler and quicker. Where it can be carried out, drainage is of use. Improvement of the herbage by liming, manurial treatment and grazing should then reduce the weed.

* * * * * *

INSTRUCTION IN CLEAN MILK PRODUCTION

1.—Clean Milk Competitions.—The detailed summary in the accompanying table gives particulars of the clean milk competitions commenced in England and Wales during the years ended March 31, 1929, and March 31, 1930, respectively. During the latter year, 35 competitions were commenced, compared with 36 in 1928-29, but the number of competitors was increased from 914 to 965, of whom 497 had not previously entered a competition. Full particulars as to analyses and advisory visits cannot be given for the year 1929-30, as six competitions were still in progress when the returns were made.

The interest of the Trade in the movement was well maintained. Eleven bonus schemes, providing either for cash prizes of stipulated amounts or for bonus payments on a gallonage basis, were operated in conjunction with competitions and, in addition, several trophies were offered in connexion with the county schemes. Donations to the general prize funds of the competitions were also made in many instances.

2.—Advisory Schemes.—In practically every county provision has been made by the County Education Authority for advisory services for dairy farmers. The plan most commonly followed is that in which the conduct of clean milk competitions and milkers' competitions plays an important part, but, in a few counties, departures have been made from the usual set plan by the introduction of special schemes, of which particulars are given below.

(*a*) *Wiltshire.*—An advisory service for licensed producers of "designated" milk was conducted during 1929, and eighteen producers took part in the scheme. Samples were taken at regular intervals for bacteriological examination, with the object of assisting producers to maintain the required standard;

CLEAN MILK COMPETITIONS, 1928-1930.

County	Commenced 1928-29					Commenced 1929-30						No. of individual producers who have competed at least once
	No. of competitors	No. of cows	No. of samples examined	No. of samples reaching "designated" standard	Total advisory visits	No. of competitors	No. of new competitors	No. of cows	No. of samples examined	No. of samples reaching "designated" standard	Total advisory visits	
Beds	—	—	—	—	—	—	—	—	—	—	—	—
Berks	31	1,251	478	445	44	35	9	1,324	556	518	50	65
Bucks	39	748	465	311	255	33	14	695	291*	156*	150*	113
Cambs	11	312	83	52	40	29	15	694	216	160	90	39
Cheshire	18	574	162	144	60	37†	27	505	190*	141*	37*	100
Cornwall	—	—	—	—	—	—	—	—	—	—	—	58
Cumberland & Westmorland	20	542	159	76	84	—	—	—	—	—	—	55
Derby	44‡	876	258	127	270	49‡	22	1,113	267	128	300	150
Devon	—	—	—	—	—	—	—	—	—	—	—	62
Dorset	—	—	—	—	—	—	—	—	—	—	—	53
Durham	25	527	200	90	120	26	19	505	208	179	160	57
Essex	16	431	128	87	61	18	16	588	162	108	36	140
Gloucester	32	900	190	154	120	41	20	1,162	370	216	200	79
Hants	46	1,594	276	109	230	68	41	2,225	204*	52*	150*	182
Hereford	—	—	—	—	—	—	—	—	—	—	—	—
Herts	73	2,258	650	394	156	71	25	2,077	639	365	160	119
Hunts	13	307	78	66	82	24	14	586	144	101	96	27
Isle of Ely	10	200	60	36	50	11	3	230	68	50	47	13
Isle of Wight	—	—	—	—	—	—	—	—	—	—	—	—
Kent	29	663	349	247	110	—	—	—	—	—	—	121
Leicester	—	—	—	—	—	—	—	—	—	—	—	79
Lincs, Holland	—	—	—	—	—	—	—	—	—	—	—	—
,, Kesteven	17	193	102	74	136	—	—	—	—	—	—	82
,, Lindsey	—	—	—	—	—	15‡	15	no record	76	38	76	52
Middlesex	14	568	126	88	65	11	4	412	99	73	70	34
Norfolk	27	780	188	97	81	56§	21	1,570	392	196	75	48
Northants	25	542	149	69	130	16	4	290	95	56	85	55
Northumberland	—	—	—	—	—	—	—	—	—	—	—	61
Notts	—	—	—	—	—	—	—	—	—	—	—	83
Oxford	30	1,045	295	178	184	24	8	686	228	155	165	66
Rutland	—	—	—	—	—	—	—	—	—	—	—	13
Salop	10	334	50	45	10	18	8	708	88	59	18	39
Somerset	—	—	—	—	—	43§	25	2,104	303	130	43	243
Staffs	—	—	—	—	—	—	—	—	—	—	—	20
Suffolk E. & W.	33	886	297	261	132	—	—	—	—	—	—	61
Surrey	40	1,369	340	261	160	40	7	1,327	240	149	150	126
Sussex, E.	62	1,800	183	117	186	79	38	2,300	317*	170*	160*	201
,, W.	24	668	203	111	68	25	17	595	214	96	85	111
Warwick	33	1,061	297	223	165	40	17	1,100	360	279	200	76
Wilts	29	1,390	252	166	90	4‖	—	183	28	15	12	164
Worcester	21	312	189	136	63	23	11	493	207	150	115	64
Yorkshire	39	782	468	356	72	39	25	788	468	396	70	133
TOTAL: ENGLAND	811	22,913	6,675	4,520	3,224	875	425	24,260	6,430	4,136	2,800	3,244
Anglesey	15§	183	79	52	98	20§	15	222	100	72	135	41
Brecon and Radnor	14	170	54	33	32	—	—	—	—	—	—	35
Cardigan	—	—	—	—	—	—	—	—	—	—	—	26
Carmarthen	—	—	—	—	—	—	—	—	—	—	—	33
Caernarvon	19	340	114	79	78	—	—	—	—	—	—	19
Denbigh	—	—	—	—	—	—	—	—	—	—	—	80
Flint	13	183	117	81	38	22§	20	330	96*	47*	61*	64
Glamorgan	—	—	—	—	—	—	—	—	—	—	—	—
Merioneth	15	135	45	27	36	18	13	186	162	116	40	28
Monmouth	—	—	—	—	—	—	—	—	—	—	—	—
Montgomery	—	—	—	—	—	—	—	—	—	—	—	18
Pembroke	27§	357	161	153	141	30§	24	390	164*	110*	118*	72
TOTAL: WALES	103	1,368	570	425	423	90	72	1,128	522	345	354	416
TOTAL: ENGLAND & WALES	914	24,281	7,245	4,945	3,647	965	497	25,388	6,952	4,481	3,154	3,660

* Figures incomplete as competitions were still in progress when the return was made.

† Includes Hyde Borough (retail) competitors.

‡ Modified schemes.

§ Two competitions were commenced during the year.

‖ Probation section of County Register of Accredited Milk Producers.

where necessary, advisory visits were paid. The scheme was continued on similar lines in 1930.

(*b*) *Nottinghamshire.*—The system adopted in this county is to co-operate with the local Public Health Department in the conduct of an advisory scheme in a particular area over a period of twelve months. At the time the return was made, two such schemes had been completed and a third was still in operation. The following summary indicates the progress of the movement :—

Period	*Mansfield.* 1/11/28–31/10/29	*Warsop.* 1/4/29–31/3/30	*Selston & Hucknall.* 1/12/29–30/11/30
No. of producers concerned	32	20	36
No. of cows in herds	410	131	699
No. of milk samples examined	409	249	137
No. of milk samples which reached "designated" standard	191	91	95
No. of advisory visits	110	70	80
No. of licences for the production of "designated" milk which have been taken out as a result of the scheme	1 Grade "A"	2 Grade "A"	Scheme still in operation

(*c*) *Lincs* (*Kesteven*).—A continuous advisory service has been introduced in the county for such producers as may wish to take advantage of the facilities offered. The scheme had been in operation only for a few months when the return was made. During this period, 9 producers had been assisted, the number of farm visits involved being 19. A total of 14 milk samples had been submitted for analysis and 7 of these fulfilled the bacteriological requirements for "designated" milk.

(*d*) *Staffordshire and Lincs* (*Lindsey*).—The schemes in these counties are carried out in co-operation with the Public Health Committees, who notify the Education Authority of cases in which unsatisfactory samples of milk have been taken. Advisory visits are then paid by the Agricultural Organizer or a member of his staff. During the year ended March 31 last, 104 advisory visits were undertaken in Staffordshire and 70 in Lindsey.

(*e*) *Leicestershire.*—A similar scheme to those described in paragraph (*d*) is carried out by arrangement with the Sanitary Inspectors and the County Branch of the National Farmers' Union. Results of analyses of samples taken by the Inspectors are sent to the Union ; the Agricultural Organizer is, in turn, notified of unsatisfactory samples and arranges for an advisory visit to be paid to the farm concerned.

(*f*) *Montgomery.*—Arrangements have been made for the Sanitary Inspectors to take surprise samples of milk from

producers in their areas. The samples are forwarded to the University College of Wales for analysis, and the results are sent to the County Education Committee, who defray the cost of examination. When an unsatisfactory sample is obtained, the farm concerned is visited by the Dairy Instructress with the object of introducing improvements. During the year 1929-30, 150 samples were submitted for analysis and 50 advisory visits were made. The Committee is satisfied with the great improvement in cleanliness that has been secured through the scheme.

3.—County Registers of Accredited Milk Producers.—This scheme must still be regarded as only in the experimental stage. Following the experience in Wiltshire in 1929, four other counties put the scheme into operation in 1930. The main objects of the scheme are (1) to provide facilities by means of which those who have attained proficiency in a clean milk competition may receive regular assistance in maintaining a high standard of production ; and (2) to provide a basis on which a system of bonus payments for milk of high hygienic quality may be established.

The conditions governing the scheme are, broadly, as follows :—

(1) In order to be eligible for registration, a producer shall have attained a satisfactory standard of production (*a*) in a county clean milk competition of six months' duration or (*b*) in the course of a probationary period of six months, during which time milk samples have been tested and farm inspections carried out on the same conditions as obtain in a clean milk competition.

(2) Monthly milk samples shall be submitted for bacteriological examination, and shall be expected to conform with definite requirements in respect of bacteriological content. In cases where three consecutive monthly samples fail to conform with these requirements, the producer concerned may be either suspended or removed from the register.

(3) The milk samples shall be tested also for butter-fat in order to detect abnormal sampling and to obtain the necessary information in connexion with any bonus schemes which may provide for extra payments in respect of fat content.

The only complete report on the scheme is in respect of Wiltshire for the year 1929. Eighteen producers were registered and two withdrew during the course of the year. A probationary section of the Register was introduced in this county in 1930, and all four producers who participated qualified for registration.

4.—Milkers' Competitions.—The following summary indicates the increased interest which is being taken in this method of instruction :—

	1928/29	1929/30
No. of competitions organized	66	76
No. of competitors	1,084	1,507
No. of competitors who reached proficiency standard	898	1,243

* * * * * *

MARKETING NOTES

National Mark Eggs.—The scheme for the sale of eggs under the National Mark continues to make satisfactory progress, and the total output of packing stations for the year 1930, amounting to no less than 221 million eggs, of which 158 million were packed under National Mark labels, shows that this scheme is becoming a well-established and successful feature of the poultry industry in this country, and is receiving steadily increasing support from poultry keepers. During the five months August—December, the output of the stations was 75 million eggs, of which 55 million were packed under the Mark, these quantities being greater than those for the corresponding months of last year by 25 per cent. and 39 per cent., respectively. The steadily growing demand for National Mark supplies has enabled these increased quantities to find a ready market. Probably as a consequence of a 30 per cent. increase in imports from Australia and South Africa, and of somewhat milder weather, compared with the previous year, the seasonal decline in prices which usually sets in during the late autumn occurred somewhat earlier in the season than was expected, and the market consequently displayed a quiet tendency, especially during the period immediately previous to Christmas.

A copy of the annual report and balance sheet for the year ended September 30, 1930, has recently been received from the Norfolk Egg Producers, Ltd., one of the largest co-operative egg-packing stations operating the National Mark Scheme. This shows that, on a turnover of over £50,000, a net profit of more than £1,000 was made, which allowed of the payment of a bonus to members of 3*d*. in the £ based on purchases from them during the two years immediately preceding the issue of the account. In spite of the fact that the station is situated in an important egg-producing area, and is purchasing its supplies in competition with all classes of egg merchants, its membership and turnover of eggs have nearly doubled during

the 12 months. These developments, coupled with the payment of the bonus to members, are indicative of the success which attends efficient co-operation as exemplified by this society.

National Mark Beef.—The weekly average number of sides (including quarters and pieces expressed in terms of sides) of beef graded and marked with the National Mark during December, 1929, and December, 1930, and the number of sides graded and marked for the five weeks ended January 17, 1931, were as follows :—

		Number of Sides
	LONDON	
Weekly average ..	December, 1929	1,198
,, ,, ..	,, 1930	2,503
Week ended ..	December 20, 1930 ..	4,154
,, ,, ..	,, 27, 1930 ..	1,325
,, ,, ..	January 3, 1931 ..	1,692
,, ,, ..	,, 10, 1931 ..	2,145
,, ,, ..	,, 17, 1931 ..	1,983
	BIRKENHEAD*	
Weekly average ..	December, 1929	254
,, ,, ..	,, 1930	836
Week ended ..	December 20, 1930 ..	741
,, ,, ..	,, 27, 1930 ..	754
,, ,, ..	January 3, 1931 ..	785
,, ,, ..	,, 10, 1931 ..	957
,, ,, ..	,, 17, 1931 ..	820
	SCOTLAND*	
Weekly average ..	December, 1929	1,371
,, ,, ..	,, 1930	2,499
Week ended ..	December 20, 1930 ..	3,455
,, ,, ..	,, 27, 1930 ..	1,654
,, ,, ..	January 3, 1931 ..	1,912
,, ,, ..	,, 10, 1931 ..	2,337
,, ,, ..	,, 17, 1931 ..	2,594
	TOTAL LONDON SUPPLIES (All sources)	
Weekly average ..	December, 1929	2,823
,, ,, ..	,, 1930	5,838
Week ended ..	December 20, 1930 ..	8,350
,, ,, ..	,, 27, 1930 ..	3,733
,, ,, ..	January 3, 1931 ..	4,389
,, ,, ..	,, 10, 1931 ..	5,437
,, ,, ..	,, 17, 1931 ..	5,397
	BIRMINGHAM	
Weekly average ..	December, 1929	442
,, ,, ..	,, 1930	487
Week ended ..	December 20, 1930 ..	678
,, ,, ..	,, 27, 1930 ..	277
,, ,, ..	January 3, 1931 ..	342
,, ,, ..	,, 10, 1931 ..	493
,, ,, ..	,, 17, 1931 ..	460

* Sides consigned to London.

During December, 1930, there was a striking increase in the number of sides of home and Scotch-killed beef that were graded and marked for London, the total being 25,852 sides, which is the highest number graded and marked in any one month since the commencement of the scheme. The totals for the weeks ended December 13 and 20 were also the record figures of 5,759 and 8,350, respectively. The number of sides graded and marked at Birmingham has continued to show satisfactory improvement since last October.

An increasing number of direct consignments of cattle is being sent from farms to the Islington abattoir for sale on a grade and dead-weight basis under the Ministry's experimental scheme. The prices obtained for the cattle have given general satisfaction, and it is hoped that more farmers will take advantage of this system of sale. A leaflet (Marketing Leaflet No. 27) explaining the scheme is being printed, and copies may be obtained, free of charge, from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

National Mark Strawberries.—It may be useful to review the first season's working of this scheme. When the formulation of the strawberry scheme for the season 1930 was mooted, the majority of those possessing knowledge of the strawberry industry expressed the opinion that the application of the National Matk scheme to this fruit was impossible. In spite of this mass of adverse opinion, a survey of the strawberry areas was made, and the possibilities of the scheme were discussed with growers at a large number of meetings. In the course of this survey, it became evident that there was a strong movement amongst strawberry growers towards precise grading, coupled with guaranteed net weights of packages, and that many growers were, in fact, grading and packing to standards approximating to those proposed in the scheme. The revelation of this movement at meetings was often a surprise to the growers themselves.

The insistent demand of the retail section of the distributive trade for guaranteed net weights and the abolition of topping, together with the definite knowledge of the shortcomings of growers in their methods of marketing strawberries, were important factors in reaching the decision to proceed with the National Mark scheme.

Before the scheme was launched, it was realized by all concerned that it bristled with difficulties, some of which were

almost insurmountable. Because of this, it was made known quite plainly that the scheme was experimental.

The fact that strawberries must be graded at the time of picking, and that the strict control of hired pickers was almost impossible in present conditions, ruled out a very large acreage of fruit at the start. It was clear, nevertheless, that a large number of growers of small acreage were able and anxious to join any reasonable scheme which aimed at better methods of marketing. It is well known that not only can small growers exercise better control over grading and picking operations than large growers but they can usually grow quite as good quality fruit as the producers. Because of this, the acreage qualification was fixed low enough to bring in the smallest commercial growers.

To meet the difficulties of grading, the standards were fixed very low. The main grade, "Selected," means little more than the culling of dirty, damaged, and undersized fruits; practically, it means the crop as picked. To meet a limited demand for berries of superlative quality and size with uniformity of colour, the grade "Extra Selected" has been established.

Authorized Packers.—Before the opening of the season, the scheme was explained to strawberry growers at fourteen meetings and a large number of individual growers were visited. As a result, 94 enrolled in the Scheme. All were advised to pack under the Mark only that portion of the crop which they could ensure would be correctly graded and packed.

Quantity Marketed.—No actual figures as to the quantity marketed under the Mark are available, but it is obvious that it amounted to only a very small proportion of the total output. In the Cheddar area, prolonged drought resulted in a light crop of small berries, and several registered growers were unable to pack even to the very low standards provided. In the Hampshire area, the crop lasted for an unusually short period and berries at the finish were small. In a large part of the Wisbech area, hail and very heavy rain ruined as much as 25 per cent. of the fruit. Delay in delivery of covers also prevented several growers from using the Mark until a part of their crop had been marketed. As indicated elsewhere in this report, the demand far exceeded the supply.

Distribution.—In spite of the small quantity marketed, distribution was more widespread than with any other National Mark fruit. Consignments went to almost all of the larger towns in Great Britain.

Inspection.—The widespread distribution and the speed with which this crop must be handled made market inspection a matter of difficulty. In Covent Garden, as well as in the provincial markets, National Mark strawberries were almost invariably sold out within a few minutes of arrival. Inspection brought to light no complaints other than that of damage due to the use of undersize chip baskets, nor have retailers, through their associations, reported any cause of dissatisfaction. Their only complaint was that supplies were too small.

Grading.—Those growers who have full control of their pickers do not appear to have experienced any difficulty in grading to the standards laid down.

Some growers appeared to think that it was compulsory to make two grades although the regulations distinctly state otherwise. Unless the crop is especially good and a salesman who has a connexion for high-grade fruit is employed, the grower will most probably incur a loss by making two grades. With the average grower it is better to pack "Extra selected" and "Selected" berries together as "Selected."

Packages.—As growers had on hand stocks of chip baskets which differed slightly in dimensions from the standards laid down, permission was given for these to be used provided that they contained the specified net weights. This concession resulted in a considerable amount of damage to fruits, but it has been a valuable object lesson in demonstrating to all sections of the industry: (1) that a large proportion of the chip baskets used will not safely hold the weight they are supposed to hold; and (2) that a very large proportion of the baskets marketed are short in respect of the purported weight of the fruit.

It is hoped that a greater measure of uniformity as regards packages will be achieved next season and that baskets which are satisfactory in respect of capacity will be generally used for National Mark strawberries.

Covers.—There has been much controversy and criticism regarding the National Mark covers, both before and since the scheme became operative. Different growers hold differing views as to the most satisfactory type of cover, but it must again be emphasized that standardization is the essence of the National Mark Scheme and it was necessary to devise one type of cover that would raise the least amount of objection generally. In spite of criticism, the cover provided seems to have served the purpose quite well. It is probable, however, that a thin pulp-board cover of the same type would serve the purpose better, but at present this appears to be too costly. There has also been some criticism of the colour of the "Selected" grade cover as being liable to detract from the colour effect of the berries, but this point, with the others, will be carefully taken into consideration when a reprint of the covers is required.

Effect of the Scheme.—That the experiment of the strawberry scheme has been justified there can be no possible doubt. Short weights and "topping" had become so common and of such long standing that both salesmen and buyers had come to regard them as inevitable, and a state of almost complete apathy existed. Propaganda before the scheme opened aroused renewed interest in this problem, and finally the incursion on the markets of National Mark strawberries generated, by example and contrast, increased activity towards ending the "topping" and short-weight evils.

As far as it has been possible to trace, growers packing under the Mark seem to have secured more profitable returns through the use of the Mark. From general observation, it would appear that there is a large demand for strawberries of high quality. A substantial number of consumers are prepared to pay good prices for good quality supplies, but will not buy inferior quality at any price. The National Mark Strawberry Scheme can render invaluable assistance to growers who are willing to make an effort to satisfy this demand.

The market value of different varieties of strawberries is a matter which the scheme has brought into prominence. It is held by many growers, salesmen and retailers that the indifferent edible quality of certain varieties is damaging the consumer-demand for strawberries, and it is freely suggested that these varieties should be excluded from the scheme. This question is under consideration.

Revision of Regulations.—The definitions of grades and sizes of berries appear to meet with general approval, but so many criticisms in connexion with covers, packages and varieties have been made that it may be desirable before next season to hold a conference of those interested in the strawberry industry for the purpose of discussing the application of the scheme in all its aspects. This matter is receiving the attention of the Ministry.

National Mark Cherries.—In reviewing the first season's working of the National Mark Scheme for cherries, it must be borne in mind that the small number of growers who were able to register during the first season, and the small quantity of cherries marketed under the Mark, do not provide much material for report.

When the scheme came into operation and growers were canvassed for registration, the season was already well advanced. Crops were exceptionally heavy and some of the mid-season and late varieties were ripening rapidly at the same time. In many cases, growers had great difficulty in obtaining suitable pickers, and the general opinion was that for the season 1930 it was too late to instruct pickers in grading and to obtain National Mark packages and overprinted labels. In the circumstances this was a reasonable attitude, and it is satisfactory to be able to report the enrolment of 10 packers in this trial season. There is no doubt that in normal conditions many more growers would have enrolled.

Adverse Factors.—In the Sittingbourne and Faversham districts of Kent, difficulties in respect of picking-labour appear to have been most acute, many growers having to rely upon overtime labour from the local brickfields for early morning and late evening picking. In order to avoid losing many tons of cherries, they were obliged to clear the trees as fast as possible, regardless of grading. Prices were satisfactory for the many thousands of ordinarily packed half-sieves that were being loaded daily, and the statement of many growers that they could not, under the prevailing conditions, properly supervise grading and packing was to some extent true. It was explained to them, however, that, in spite of the rush they were experiencing in getting the heavy crops gathered, they could market their half-sieves under "Selected" grade, which meant only the additional labour of tying on the National Mark label. They feared, however, that their salesmen would at once think that, if receiving National Mark "Selected" grade only, the "Extra Selected" were going to other salesmen. Another difficulty in regard to picking-labour in some of the Kent districts is that the dealers who buy orchards at auctions generally collect most of the best pickers by offering a higher wage.

The established custom of many growers in Kent of selling their cherry crops on the trees by auction can hardly be of much benefit to the scheme. As the result of these auctions, the fruit is bought, picked and marketed by fruiterers and dealers. Their methods are usually very rough. The greater portion of the cherries sold by these men goes direct to retailers in the coast towns—a method of quick sale with little expense which undoubtedly suits their purpose. It is not likely that many of these dealers will become National Mark packers.

General Observations and Recommendations.—For the purpose of obtaining observations upon the scheme, the authorized packers were

re-visited at the close of the cherry season. Although packers felt that they had seen too little of the scheme during the first season to say much about it, the following points have been put forward for consideration :—

(a) *Statutory Definitions of Quality.*—One important Kentish grower considers that the minimum sizes of $\frac{7}{8}$ in. and $\frac{11}{16}$ in. for the two grades, respectively, might be raised, or, as an alternative, minimum sizes for individual varieties might be laid down. It is realized that to set up size standards for the large and small varieties would tend to make the scheme complicated, but large varieties, such as "Rivers," "Roundells" and "Napoleons," certainly appear to merit special size standards, although, as some of the largest cherries in the country are grown in the Kentish district, the raising of the minimum size for certain varieties might exclude from the scheme packers in other parts who do not grow such large-size fruit. It must be remembered that the requirements of "Selected" grade represent little more than is done by the ordinary packer, *i.e.*, culling for blemish in transferring the fruit from picking receptacles to the market packages.

The recommendation is made, therefore, that, for the season 1931, the grade definitions should remain as at present, but that during the next cherry season the practicability of setting up minimum sizes for certain varieties should be carefully investigated with the object of a possible separation of the main commercial varieties into two classes.

(b) *Packages.*—One packer who specializes in 6-lb. boxes of high quality "Napoleons" has suggested that 6-lb. packages should be permitted for "Extra Selected" grade. Other packers would like the 4-lb. chip to be included for "Extra Selected" grade, and it is recommended that this package, together with the 3-lb. chip, should be included in the scheme for this grade.

The 6-lb. box is not considered necessary for "Extra Selected" grade. It is a well-known fact that in the course of distribution small boxes are frequently thrown about, but chip baskets—having handles—are generally treated more kindly.

The fact that there is an increasing tendency on the part of cherry growers to disregard returnable wicker packages in favour of chips and other small non-returnables promises well for the future. Prices for best-quality cherries in chips have been highly satisfactory. Although, in some instances, growers, in turning to chip baskets after years of packing in wickers, have been returned the same price per lb. whatever the package, and have also been asked by their salesmen not to send chips, most of these growers intend to persevere with the chip package.

National Mark Apples and Pears.—Further authorizations in the apple and pear scheme have brought the number of packers up to 96 for apples and 18 for pears, compared with 71 and 9, respectively, a year ago.

The large demand for National Mark apples has again been greater than the supply, and uniformly good prices have been received throughout the season.

National Mark Canned Fruit, Peas and Beans.—The Ministry has been informed by a firm of distributors acting as export agents for an authorized canner that they are sending National

Mark canned fruit to India. A supply of display material for use in connexion with this overseas trade has been sent to the firm concerned.

National Mark Wheat Flour.—In view of the fears expressed regarding the quality of National Mark wheat flour derived from the 1930 crop, it is gratifying to find that, as a result of extended baking tests, National Mark "Yeoman" flour made from wheat harvested in 1930 possesses more uniform baking qualities and greater strength than that from the crop of 1929, and that it is capable of carrying half-a-gallon more water to the sack.

Comparison of the analyses of the flour from the 1929 and 1930 crops shows that, while the ash content is lower this year, the moisture-content, owing to the nature of the season, is naturally somewhat higher. The actual figures are :—

	1929 *crop* (154 samples)	1930 *crop* (41 samples)
Average ash content	0·51 per cent.	0·49 per cent.
Average moisture content ..	14·33 per cent.	14·81 per cent.

From the miller's point of view, more care must be taken this year in selecting wheat intended for milling National Mark flour, but, subject to this provision, there is every prospect that the high uniform quality of National Mark flour will be maintained.

The following additional firms have been enrolled in the Scheme as authorized re-packers :—

Glendale Co-operative Society, Ltd, Wooler, Northumberland.
Hasler & Co., Ltd., Dunmow, Essex.

Publicity for National Mark Produce.—In connexion with the Ministry's National Mark exhibit at the Birmingham and Midlands Grocers' and Bakers' Exhibition at Bingley Hall, Birmingham, January 13-24—reference to which is made below—hoarding posters advertising National Mark beef, dressed poultry, eggs, flour, apples, canned fruits, canned peas and beans, and malt extract with cod liver oil were displayed in Birmingham and district for four weeks in January, and special advertisements were inserted in the local papers.

Following the advertising in London up to the end of December, by means of side streamers on the omnibuses, of National Mark beef, canned fruits, canned peas, and malt extract with cod liver oil, a further contract has been arranged, covering the first three months of 1931, for National Mark beef, eggs, and canned fruits to be advertised in a similar manner. One firm of canners has already followed the Ministry's

lead and arranged for 'bus advertisements of their own brand of National Mark canned fruit, and it is understood that another large firm of canners has been so impressed with the merits of this form of publicity that they are proposing to make similar arrangements.

Extensive publicity has been arranged in connexion with the inauguration of the National Mark Beef Scheme in Leeds, Bradford and Halifax on January 26. As part of the preliminary propaganda, two meetings were held on January 12 in Leeds and Bradford, over which the respective Lord Mayors presided. Over 500 persons attended the meeting in the Town Hall, Leeds, including a large number of meat traders, when the National Mark Beef Scheme was explained by Earl De La Warr, Parliamentary Secretary to the Ministry, supported by Mr. W. Lunn, M.P., Vice-Chairman of the Empire Marketing Board, and Mr. G. H. Collinge, O.B.E., a past-President of the National Federation of Meat Traders' Associations.

Lord De La Warr was supported on the platform by a number of local Members of Parliament, together with other leading citizens of the area. The speakers received a very sympathetic hearing from the audience, and the questions which followed were in no sense of a hostile nature. The meeting concluded with a short display of National Mark films.

At the evening meeting at Bradford, which was also addressed by Earl De La Warr and Mr. Collinge, the audience numbered some 400, and, from the large number of questions, it was evident that the proposed introduction of the scheme was arousing a keen interest in the locality. As at Leeds, a short film display concluded the meeting.

A further meeting for women only was held at the Rialto Cinema, Leeds, on January 22, when the programme consisted of a display of Empire Marketing Board film, and of the Ministry's National Mark films, together with speeches during the interval by Lady Cynthia Mosley, M.P.

In addition to this form of propaganda, a programme of Press advertising has been commenced in the newspapers circulating in Leeds, Bradford and Halifax, while the display of a special 16-sheet National Mark beef poster has been arranged on a large number of hoardings in those towns.

Reference was made in the December issue of this JOURNAL (p. 914) to the National Mark Flour Cookery Competition, arranged under the joint auspices of the Ministry and the

National Federation of Women's Institutes. The following fourteen County Federations have so far intimated that they have decided to hold county competitions—Montgomery, Oxford, Lancashire, Isle of Wight, East Suffolk, Cumberland, Monmouth, Cornwall, Shropshire, East Sussex, West Sussex, Stafford, Huntingdon, and Somerset.

The second edition of the booklet, "The National Mark," printed in July, 1930, has been widely circulated, over 500,000 copies having been distributed in a little over six months. Copies of the booklet may be obtained, free of charge, on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

An instance of what can be done by interested organizations to augment the efforts of the Ministry to stimulate the demand for National Mark commodities, especially among producers, is afforded by the plan which the Isle of Ely Branch of the National Farmers' Union has adopted to advertise National Mark flour in its area. It has issued to its members, for use on their correspondence, supplies of an attractive adhesive stamp, bearing the National Mark and the words: "Buy National Mark Flour and All-English Bread and Support Home Agriculture."

The farmers of this important producing area are to be congratulated on their initiative, which should result in an increasing local demand for National Mark flour.

Displays of Home Produce.—From January 13–24, a display of National Mark produce was staged at the Birmingham Grocers', &c., Exhibition, held in Bingley Hall. This is being followed by a fortnight's display of home produce by the Ministry at shop premises in Birmingham, rented by the Empire Marketing Board for the purposes of the display and sale of samples, in turn, of the produce of the United Kingdom and of the various Dominions and Colonies.

At an Exhibition of the English Folk Cookery Association, held at the Lecture Hall of the Gas Light and Coke Company, Church Street, Kensington, on January 16, National Mark produce was displayed, including National Mark flour, eggs, canned fruits and vegetables, beef and poultry. A feature of the display was a variety of loaves, cakes, buns, pastry, etc., made from National Mark flour.

Iowa: A "National Mark" for Butter.—In last month's issue of this JOURNAL, reference was made to the marking or labelling schemes for agricultural products which have been

introduced by some of the American States, following the establishment of statutory grades for the products raised in their areas; and a description was given of one of these schemes—the New England Farm Marketing Programme.

Another scheme—which resembles, in many respects, the National Mark schemes in this country—is the Iowa butter-marking scheme, described below.

Iowa is one of the leading butter-producing states in the U.S.A., being second only to Minnesota in the quantity produced. Not all parts of Iowa are suited to the production of the best quality butter, however, and there was a feeling that the sale of Iowa butter in the Eastern States was being prejudiced by the inferior qualities that were being put on the market. The need for some means of identifying and guaranteeing high quality led to a demand for a State brand.

Accordingly, in 1927, the State Assembly passed a law, the purpose of which was "to promote educational work which will assist Iowa butter-makers in producing butter to be marketed under a State trade-mark and thereby ensure a more uniform market and higher market value for the butter manufactured in the State."

A State trade-mark was adopted (reproduced opposite), the use of which was to be restricted to creameries that agreed to conform to certain rules. Among these rules, the following may be quoted :—

All the creameries must fulfil certain sanitary requirements.

Of the butter produced in the creameries, at least 75 per cent. must score, on quality, not less than 93 points. A creamery obtaining less than 93 points, or having more than 25 per cent. of its scoring below 93, forfeits the right to use the trade-mark.

The butter must contain not less than 80 per cent. of butter-fat and not more than 16 per cent. moisture.

No preservative, neutralizer, or adulterant may be added to the butter or to the cream from which it is made.

The cream or milk used in the manufacture of the butter must have been pasteurized.

Upon the request of the Executive Committee in charge of the scheme, a creamery must send butter from its most recent churning for the purposes of scoring to such places and in such quantities as designated by the Executive Committee.

Violation of any of the rules is a misdemeamour rendering guilty parties liable to a fine of not less than $25 or more than $100, or imprisonment for not less than 30 days.

There are, at present, about 30 State Brand Creameries in Iowa, producing, in the aggregate, 9,000,000 lb. of butter annually, as well as over 500,000 lb. of sweet cream. The

average price received for butter by the patrons of these creameries appears to have been between 15 cents and 45 cents above that of other creamery patrons in the State. It is interesting to note that 15 of these creameries have formed a central organization for the sale of their products on the markets.

Trade Mark adopted for First Quality Iowa Butter.

Loans to Co-operative Marketing Enterprises.—Since 1924, provision has been made annually by Parliament to enable the Ministry to make loans to agricultural co-operative enterprises registered under the Industrial and Provident Societies Acts and engaged, or proposing to engage, in the preparation and marketing of agricultural produce. These loans, for which security is required, are normally made for the acquisition of land, buildings, machinery, plant and equipment.

Loans are made for periods up to 20 years, repayable by half-yearly instalments, and interest is charged at 5 per cent. per annum. In certain circumstances, a loan may be made free of liability for interest for an initial period up to five years. Repayment of capital may, in certain circumstances, be deferred for a period not exceeding two years.

Each application for a loan is considered by an Advisory Committee. On the recommendation of that body, the following loans, amounting in all to £50,170, have been granted to the undermentioned 13 societies since the scheme was instituted :—

Year	Name of Society	Amount of Loan £	Period	Remarks
1924	East Grinstead & District Producers, Ltd.	120	7 years	—
	Co-operative Poultry Products, Ltd.	5,800	15 years	Loan repaid in full on liquidation of Society.
1925	Farmers' Milk Depot Four Crosses, Ltd.	2,050	17 years	Loan repaid in full.
	Southern Wool Growers, Ltd.	3,500	12 years	In addition to normal repayments, £715 was repaid, August, 1928, on sale of part of security.
	Horeham Road Co-operative Society, Ltd.	1,000	17 years	Loan repaid in full on sale of security.
	Oxfordshire Farmers' Bacon Factory, Ltd.	7,500	17 years	Loss to public funds on liquidation of Society, £1,136.
	Lincolnshire Co-operative Bacon Factory, Ltd.	1,500	12 years	Loss to public funds on liquidation of Society, £1,167.
	Kent, Surrey & Sussex Farmers' Bacon Factory, Ltd.	10,000	17 years	Loss to public funds on liquidation of Society, £7,831.
	Cottenham Growers, Ltd.	200	10 years	In voluntary liquidation.
1927	Yorkshire Farmers' Bacon Factory, Ltd.	10,000	20 years	—
1928	Derbyshire Farmers, Ltd.	3,000	15 years	In addition to normal repayments, £162 was repaid, April, 1929, on sale of part of security.
	Gloucestershire Marketing Society, Ltd.	1,500	17 years	£500 repaid, October, 1930.
1929	Berks, Bucks & Oxon Farmers, Ltd.	4,000	20 years	—

During 1930, the Advisory Committee considered applications for loans submitted by two societies, and on the Committee's recommendation the Ministry has recently offered them loans amounting to £5,328.

Since the inception of the scheme, four further loans, amounting in all to £9,200, have been offered by the Ministry to four societies, three of which were dairying societies, but the societies were unable to comply with the conditions attaching to the loans which, therefore, were not paid over.

Full particulars as to the terms and conditions under which

loans may be made are given in Marketing Leaflet No. 19, copies of which may be obtained, post free, from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

Organization of Marketing.—The following appears in the editorial notes in the December issue of *Agricultural Business*, which is published by the Welsh Agricultural Organization Society and the Department of Agricultural Economics, University College of Wales :—

The greatest assistance in improvement of farming and of standards of living is now to be obtained through marketing organizations ; and until marketing is better organized little improvement can be expected. If cleaner milk or a higher butter-fat content is desired—not wholly or necessarily in the consumers' interest—the best way to secure it is through a farmers' organization handling milk and paying on bacterial count and butter-fat standard. When evening out of the milk supply and the dissipation of seasonal surplus are required, there is no better way than through a farmers' selling organization. The difficulties of a seasonal egg supply are best explained to farmers by an agency selling on their behalf. Meat animals fitted to the market demands would be sooner in general supply if a greater part of the marketing process was under farmers' control. When farmers begin to consider market demands, they must begin to consider their fundamental technical methods in relation to the methods of producing to meet the demand. Better grassland management, more and better manuring, better rationing and feeding, better breeding and rearing are paid for only through the markets for livestock and their produce. Blind production pays only by chance. Organized marketing is bound to lead to organized production and the improvement of methods.

Organized marketing is now the best road to better farming. When a farmers' organization faces the markets it is able to tell farmers what is required, and if necessary it can tell effectively and cheaply how to set about producing the required type or quality. With the farmers' organization and its members there is no division of interest such as exists between the farmer and the dealer. The member is interested in getting the best market ; the organization in offering the best product, and by joint action the common need is served. The farmer accepts advice and direction from his own organization more willingly and quickly than from any other source. There are numerous examples of this effect of farmers' marketing organizations, but the principle is so clear that it scarcely needs demonstration. No other way offers such great and reliable possibilities of improving farming as the supply of advice through farmers' own organizations. Breeding, selection, feeding, general management, have all been affected for good in this way.

Better farming depends on sound marketing before its objects can be reached. Better marketing has as its objective the improvement of financial returns, but this is often dependent upon an almost equal improvement in actual farming. But neither farming nor marketing are ends in themselves ; their object is the increase in financial returns for the provision of a better standard of living. The shortest avenue to a better standard of living on Welsh farms is now to be found through the improvement of marketing organization and processes and linking these with the processes of farming under the direction of bodies controlled by agriculturists and working in their interests.

Organized Marketing: A Scottish Opinion.—In the course of a wireless talk given recently, Mr. Joseph Duncan, Secretary of the Scottish Farm Servants' Union, said :—

"In the past, the farm as a separate unit has occupied the foreground, and all our effort has been to improve production on the farm. It is from that position that we have viewed the industry. I suggest that, without losing sight of the farm, we have to think first of the market and work from that angle. It is on the market that revolutionary changes are taking place, to which the farm will have to adjust itself if it is to continue.

"These changes have been developing for some time, but the pace is rapidly increasing. The principal causes are the development of mechanized grain growing and handling in America, in Australia and in Russia. Wheat does not bulk largely in Scotland, but it affects the price of other grains. In oats and barley, we have to face increasing competition while at the same time the market is steadily shrinking through the increase of motor traction, and we have to adjust our agriculture to that fact. When we turn to milk and dairy products, we are faced with increasing supplies of high quality products from the Continent and from the Dominions. The recent developments in refrigeration will lead to an improvement in the quality of overseas meat supplies, which may become formidable competitors in the meat market.

"The developments in the retail distributive trade are all in favour of our overseas competitors and against the individual marketing on which our agriculture is run. Our overseas competitors must grade and bulk their produce because they have to send it long distances. The co-operative distributive societies and multiple firms, buying in large quantities, find it easier to get what they require from the importers. Until British farmers can enter the market in the same way they will find the buyers will continue to go past them.

"Other factors enter in besides grade and bulk, but it is the greatest mistake to imagine that price is the determining factor. Great Britain is not the market for the cheapest farm produce; it is the market for the best. It buys far more of the higher priced foodstuffs than of the lower. It is distinctly a quality market and will pay the price for the best.

"Even in the market which is free from foreign competition—the liquid milk market—we find the same development going on in Scotland. The large co-operative distributive societies are securing an increasing share of the retail trade, while the merging of wholesalers is going on steadily. The individual farmer is in a hopelessly weak position when he goes to sell milk in such a market.

"Agriculture will have to develop a marketing organization to meet the new conditions, or submit to the conditions imposed by the distributors. It is not that the distributive trades have any animus against our own farmers. They will drive the best bargain they can whomever they buy from, just as the farmers will, whomever they sell to, but there is no reason to suppose that they would rather sell Danish bacon or New Zealand butter than equally suitable produce from our own farms. They will buy what they can sell to their customers. The customers have no prejudice against home produce.

"The market must be studied, and continuously studied, and it must be stimulated to buy home produce. The farmer cannot, of course, follow the turns of the market. That is a job for the specialist. If the farmers are alive to the requirements of the new situation, the specialists will be their servants; if they neglect their opportunities they will become the servants of the distributors.

"I am not offering organized marketing as a panacea for all the ills of agriculture. All that I am suggesting is that as the market changes we have to adjust our methods and our thinking to the new conditions. The old problems will remain of what to produce and how to produce it. Organization will not guarantee us a market, but it will enable us to understand it better. It will not guarantee a price. The market will continue to change, new competitors will appear, and the old problems remain in a new setting. All I am suggesting is that we shall be better able to meet them if we rely on team work."

The International Commission of Agriculture and Organization of Marketing.—The International Commission of Agriculture, at its meeting at Antwerp in August last, adopted the following resolution :—

"The International Commission of Agriculture recommends Governments and peoples to bear in mind that in both exporting and importing countries the basic condition—which must be satisfied if the crisis is to be overcome not only in agriculture, but also in industry, trade and commerce—is an equitable increase in the prices of agricultural products.

"It recommends agriculture to seek the solution of the price problem in the creation of national selling organizations, which will be an indispensable preliminary to the achievement of international agreements."

Germany: Rationalization of Dairies.—By the recent opening of a new milk "Centrale" belonging to the Bayerische Milchversorgungsgesellschaft at Nürnberg, the mass movement in the dairy industry in Bavaria has progressed a stage further. The new plant cost some £171,500 to build, is said to be the largest of its kind in Europe, and is capable of dealing with from 33,000 to 40,000 gallons of milk daily. In the butter-making section, 18 cwt. of butter can be made and packed in an hour without being handled. There are also sections for making cheese, dried milk and "Yoghurt." Within the new building, space has also been provided for offices and store-rooms of such kindred enterprises as the Bavarian "Mark" Butter Sales Co-operative Society.

The organization is, to a large extent, a joint municipal undertaking, 45 per cent. of the shares being held by Nürnberg, 12 per cent. by Fürth and 3 per cent. by Regensburg, the remaining 40 per cent. of the shares being held by agricultural interests to the extent of 25 per cent. and the distributing trade 15 per cent. It already operates 100 collecting stations, 620 distributing centres, and supplies 1,200 wholesale distributors, and one result of its activities is that the number of milk retailers in Nürnberg has been reduced from 1,300 to 480.

American Marketing Policy.—In the course of an address to the National Association of Marketing Officials in Chicago, appealing for the support and co-operation of every agency and individual interested in the permanent betterment of agriculture, Mr. Alex Legge, Chairman of the Federal Farm Board of America, said, according to the official press release :—

"A long-time constructive programme for agricultural marketing involves three principles—first, to produce that quality of product which can retain its position against the same commodity produced elsewhere or against the substitution of something else; second, to endeavour to produce the quantity for which there is a potential buying demand at remunerative prices; third, so to improve the marketing process that the producer may obtain for his product what it is reasonably worth.

"All of this does not necessarily involve an increase in the price level to the consumer. Distributing costs and the present system of merchandising pretty nearly everything, and the service that the consuming public demands, leave a broad field of possibilities for better returns to the producer derived from economies and improved practices for getting their product to the consumers. In a condition where only 39 cents of the consumer's dollar for bread can be traced farther back than the baker (in other words, 61 cents of the dollar is absorbed in the process of baking and distributing the product, 39 cents covering the allowances for grower, miller and transportation), it does not follow that an increase in the price of wheat need necessarily increase the cost of the loaf of bread.

"As long as you have ten or a dozen different milk wagons tramping the streets and alleys of the city delivering small packages of products to various consumers located in the same building, there are possibilities of a gain at both ends of the line, and this has been demonstrated in a sufficient number of cases to prove rather conclusively that it can be done. As long as it costs more to get a little package of fruit from the railroad car in the Chicago yards to the consumer's table than the entire cost of producing and packing and hauling it a distance of over two thousand miles to town, there certainly remains ample opportunity for betterment.

"And this leads me to a final thought to which I invite your attention. It is this: after many years' study and consideration of the ills of agriculture, the cause behind them and various proposals for their correction, the Congress, in the Agricultural Marketing Act, recognized the problem of the rehabilitation of agriculture as a national one, and declared it to be the public policy of the Government of the United States to assist in the establishment and development of a producer-owned and controlled co-operative system for marketing agricultural commodities."

South Africa: Export Bounties on Butter and Cheese.—A short summary of the provisions of the Dairy Industry Control Act, 1930, was given in this JOURNAL for October, 1930. The Act made provision whereby the Dairy Industry Control Board, which was incorporated under the Act, could impose a levy on all butter, butter substitutes and cheese manufactured in or imported into the Union; this levy was to be utilized *inter alia* to pay an export bounty on butter and cheese. Regulations which have recently been issued under the Act show that the Board has now imposed a levy of 1*d*. per lb. on all butter, butter substitutes and cheese manufactured in or imported into the Union. Out of the funds derived from this levy a bounty is now being paid on graded butter and cheese exported from the Union. The amount of the bounty, which varies according to the grade of the two commodities, ranges from 3*d*. to 6*d*. per lb. in the case of butter and from 3*d*. to 3½*d*. per lb. in the case of cheese. In pursuance of a recommendation made by the Board, a further regulation has been issued which prohibits the importation of butter into the Union from all sources other than from the adjoining British Colonies and Protectorates, except under licence granted by the Minister of Agriculture. The quantity of the supplies and the period during which they may be imported under such a licence will be fixed by the Minister.

Scottish Milk Agency.—The following note is a synopsis of a recent address by the Manager of the Scottish Milk Agency, which has attracted much notice as a venture in the field of co-operative marketing. Mr. Magee's address, when the winding-up of the Agency was recently under consideration, was full of interest, reviewing the affairs of the Agency and diagnosing its weaknesses, but of especial value was his analysis of the fundamental problem of organized marketing, particularly in the milk industry.

The first part of the address sketches the history of the Agency. Before it came into being in 1927, there had been annual negotiations between the Milk Committee of the National Farmers' Union of Scotland and representatives of creameries and the distributive trade. The main difference in the new system was that—

"The Agency assumed a legal and binding obligation to pay a basic price to every one of its members, irrespective of whether their milk could be sold in the liquid milk market or not, and its membership was, for all practical purposes, unlimited."

The first year of operation was comparatively successful and ended with a profit of £20,000 because: "The price of our product was fixed in accordance with the general market conditions, or perhaps it would be more correct to say that fortunately the market conditions turned out to be favourable towards the prices which had been fixed."

In the second year "the old traditions and practices of the Conference Agreement (wherein a price was fixed without any regard to liability, because, before the birth of the Agency, there was no liability) were imported into the affairs of the Agency with all its responsibility to pay the fixed prices whether the milk could be sold or not."

Owing to outside influences, the price, according to Mr. Magee, was fixed too high, with the inevitable result. The Agency's liability was widened, production was increased by almost every producer up to the limit of his 10 per cent. allowance, the levy on the members and the revenue obtained from surplus milk were quite inadequate to meet the liability of the Agency, and the reserve built up in the first year was depleted.

The year 1929-30 was also one of difficulty in which the Agency was faced with an increasing volume of surplus milk. Markets which had been previously utilized for dumping surpluses were no longer open and cheese-making was comparatively unprofitable. Once again, to add to the Agency's difficulties, extraneous influences forced the price, in September, 1930, up to 1*s.* 2½*d.*—a price which increased the Agency's liability to its members and necessitated the imposition of a 3*d.* levy which had to be carried over to October.

The difficulties of the Agency seem to have arisen from two main causes: (1) that it had not control over *all* milk producers, and (2) that pressure was brought to bear on the Committee of the Agency to keep the price of liquid milk at too high a level. On these points Mr. Magee's remarks are significant:—

"The Agency was a self-contained trading concern; it had a contractual liability to every member in the Agency; an unlimited liability on one end of the scale and an unknown market at the other. In the circumstances, to fix a price for your produce regardless of your liability, and then to rely upon a levy to cover that liability, is to outrage the elementary rules of commercial practice. The business of the Agency was to sell its members' milk and not to run an Insurance Society for the benefit of those who were not its members, the premium for which was paid by the members."

When he deals with the constitution of the Agency, Mr. Magee attributes its weakness partly to the fact that it took on the complexion of the conditions of the trade before it.

Each farmer's basic production was fixed on the amount produced in the winter months with a 10 per cent. variation each way, and anything in excess of this was to be regarded as surplus.

"No sooner did the fact of the summer surplus clause, whereby members were paid only the factory price for any part of their production which was above the basic winter quantity, become known, than there was a general demand for members to increase their basic quantity in order to escape the liability for summer surplus."

Herein seems to have lain the source of the Agency's trouble. The liquid milk price fixed by the Committee so stimulated production that, in order to cope with it, the Agency was finally forced to raise its levy, and this led to dissatisfaction and disaffection on the part of the members.

Looking to the future, Mr. Magee states that there is still a widespread feeling that organization in the milk industry is necessary, and in putting the question, "Why the demand for further reorganization?" he makes some pregnant remarks.

"If, by reorganization, you are once again going to make the attempt to put a ring round Glasgow and to attempt a classification of liquid milk suppliers, and for the inner circle to say to the outer circle, "You keep out of here until you are wanted and get on with your cheese-making, and in the meantime we will try and get you some form of protection against imported manufactured products"—you might as well abandon the effort. It is an outworn system and as dead as the dodo. . . . To begin with, the outer circle man may not want to make cheese. He may not like doing it. . . . In any event, he is not the man who is creating your problem. Your problem is the producer within the inner circle who . . . has so stimulated winter production . . . that you have not only created an intolerable burden for yourselves but unreservedly placed yourselves in the hands of your distributors."

Mr. Magee sees little hope in the recommendations of "another prophet" that producers and distributors should "get together" in a spirit of mutual trust.

"You are sellers of a product and the dairymen are buyers of what you produce, and after thirty years' business experience I am convinced that there is no way in which those opposing elements can be brought together except on the basis that the dairymen are your customers and not your masters."

Commenting on the distributors' margin of 10*d.* per gallon, he says :—

"By comparison with distribution margins elsewhere it is no more than sufficient so long as distribution is conducted in the manner in which it is at the present time . . . If it is necessary that there should be a new orientation in the dairy farming industry I see no reason why there should not be one in the distributing trade also, and it would probably be for their good as well as ours."

There are some significant remarks on the subject of price determination.

"To my mind, the troubles of the dairy-farming industry in this country all spring from the fact that we are inclined to view it from the angle of our liquid milk market and thus become involved in the problems of the milk distributors. . . . At the moment, the whole industry is striving after an assumed liquid milk price and nobody knows who is to get it. . . . To build up a marketing organization upon an assumed liquid milk price which only represents a part of the total of the product concerned is like building a house on shifting sands. . . Every dairy farmer is striving after an artificial standard. The whole of the industries allied to milk production lie languishing and neglected. . . . I venture the opinion that the only true perspective for the dairy-farming industry is to view milk from the angle of its manufacturing value and to move upwards from there by stages until you reach its true economic level, but never to go above it."

As to the necessity of organization of producers he is not in the slightest doubt :—

"The troubles of your Agency, if you will forgive me saying so, are not so much due to bad management as they are due to bad membership. If you are in earnest about the organization of your industry, then you must work for it, and, if need be, fight for it, for believe me you will be organized anyway. . . . Either you will organize yourselves or the dairymen will organize you in a manner which suits their own ends best. . . . Either you will be a free and independent community of dairy farmers, working out a broad and comprehensive policy for the betterment of your home industry, or you will be chained to the chariot of the milk distributing trade."

Organized marketing, he concludes as a result of his survey, is fundamentally right :—

"It is right, because as individual producers and marketing entities you could accomplish nothing, but organized you could accomplish anything. Both history and industry teach us that much. Unquestionably organization is fundamentally right, but it must be your own organization and not the invertebrate servant of another."

Report on Fruit Marketing.—Number 24 of the Ministry's Economic Series of Reports has now been published as a "Report on the Preparation of Fruit for Market, Part II."* Part I dealt with the preparation for market of apples, pears, plums and strawberries, and appeared, as Economic Series No. 21, in October, 1928. The present Report, which, like its predecessor, may be described as a "Grower's Guide to Standardization," deals with the remainder of the fruits commonly grown for commercial purposes in this country, viz., gooseberries, currants, cherries, raspberries, loganberries, tomatoes, cucumbers and grapes.

The first section of the Report discusses certain general questions common to the preparation for market of all the fruits concerned. It covers such matters as (*i*) varietal characters in relation to market requirements, (*ii*) picking, (*iii*) the importance and methods of grading, (*iv*) packages, covers and labels, (*v*) cold-storage, (*vi*) the marketing of fruit for jam-making, canning and bottling, and (*vii*) the relation of growing areas to consuming markets. This section also describes the existing arrangements for the grading and marking, with the National Mark, of tomatoes, cucumbers and cherries, under the Agricultural Produce (Grading and Marking) Act, 1928.

The remainder of the Report consists of a more detailed treatment, for each fruit separately, of varietal characters, methods of picking, grading and packing. Grades are defined and packages are suggested for each of the fruits mentioned. The grades and methods of packing of tomatoes, cucumbers and cherries are those prescribed for National Mark purposes.

* *Report on the Preparation of Fruit for Market (Part II : Gooseberries, Currants, Cherries, Raspberries, Loganberries, Tomatoes, Cucumbers and Grapes).* Economic Series No. 24, H.M. Stationery Office. Price 6*d.* net. Post free 9*d.*

The Report is thus primarily for growers and packers of fruit and, in these days, no grower or packer should be without it. As the Report states, "the retailer's trade is becoming specialized and he buys only those grades which his customers require. If he cannot obtain adequate supplies of graded home-grown fruits, his only alternative is to buy graded and standardized imported produce. The home-grower must adapt his methods to these changing conditions of trade." The grades and packs suggested in the Report have been worked out as a result of a close study of the requirements of distributors on the big urban markets. For this reason, although the Report is primarily intended for the grower and packer, much of the information it contains will be of value to all sections of the distributive trade.

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FEBRUARY ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,
Director of Agriculture for West Sussex.

Arable Land.—Towards the end of this month, opportunities may occur for sowing grain crops. All spring-sown cereals require a good tilth; hard places and clods are not a suitable seed-bed for any cereal, but wheat with its deeper rooting system is less exacting than oats; barley is a shallow-rooting plant and requires a really good tilth. The fertility of the soil may compensate to some extent for indifferent tilth and produce a satisfactory crop, but, even under such conditions, the production of a good tilth is well worth while. The poorer soils must be worked to a good tilth and an ideal seed-bed secured in order to grow a full crop. The practical test is to drag the toe along the soil about three inches deep and if it meets with no obstruction then the tilth may be considered satisfactory. For barley, and especially where good grain of malting quality is required, the seed-bed should not only be fine but dry. Such a seed-bed stimulates the roots to seek for moisture and promotes a healthy appearance of the plant. On land where roots have been carted off, the tilth will be best obtained if the land has been ploughed for some time and weathered. Where roots are being folded off, this is not possible and a tilth has to be made. The depth at which land should be ploughed, after sheep have folded off the root crop, will vary with the natural fertility of the soil. Soils that are naturally poor should be ploughed comparatively shallow, about 4 or 5 inches deep, so as to keep the

manure well within reach of the grain crop; but on richer soils the ploughing can be done to a depth of 6 or 7 inches. In both cases the ploughed soil should be tilled to distribute the manure and make a tilth.

The spring-tined harrow is a very good cultivator for securing a seed-bed and with the ordinary seed harrows will usually be sufficient. If weather permits, it is a good practice to give another harrowing just before the grain appears above ground. This breaks any crust that may have been formed, and stimulates the growth of the plant. Even if no crust should form, this late harrowing is an advantage, especially if grass or clover seeds are to be sown later.

Farmyard Manure.—At this season of the year, when so many of the livestock are housed, farmyard manure is being accumulated. There have been times, and there are still instances, where stock have been and are kept primarily to produce farmyard manure.

Systems of farming based on corn growing have depended largely on stock to tread straw into manure and thus provide a means whereby fertility could be restored and added to the soil. Great care was taken of the manure to preserve its value and prepare it for application to the soil. Higher costs of labour and reduced values of grain, together with the knowledge that artificial manures and green crops ploughed into the soil can bring about much the same results, have rightly modified the practice of making manure for its own sake. Less careful attention to the manure is evident in many districts, and the modern tendency is to convey it to the land with as little labour as possible. Casting or turning the manure heap about a month before it is to be applied to the soil is much less frequently done now than formerly.

On a costing basis, at present values, farmyard manure cannot give direct profit when applied to grain crops; it can be more economically used for crops of higher value per acre, such as mangolds, potatoes, and market garden crops generally. Whatever its use, the labour costs involved in its application to the land are not lessened by allowing avoidable wastage; where such wastage occurs, the returns will most certainly be reduced. The best manure is made in boxes or covered yards, where the manure can remain for a time and is trodden firm by the cattle. Such manure, if moved to a mix a few weeks before it is applied to the land, will retain the greatest amount of fertilizing material that is

possible under practical conditions. Manure made in open yards is exposed to rainfall and a certain amount of waste occurs.

Milk production methods are wasteful of farmyard manure. The manure must be removed daily and unless packed tightly in a heap and protected from heavy washing by rain, deterioration is inevitable. Liquid manure has to be conveyed away by drains, and if a tank is provided it frequently overflows and may pollute a stream or ditch ; in any case the overflow continues. Matters are further complicated by the necessity to wash down the floor of the cowstall, and unless a double set of drains is provided the liquid manure is so diluted that its value as a manure is very much reduced.

Opinions vary as to the value of liquid manure. Some farmers make the fullest possible use of all the liquid available ; others never touch it unless compelled to do so to maintain the drainage system or to prevent it becoming a nuisance. Many expensive systems of distribution by pipes and conduits have been installed from time to time, and whilst a few are kept in order and managed successfully a great many have been more or less abandoned. When the liquid manure can be turned into a stream of water that can be used for irrigation purposes considerable benefits may be obtained, but the natural conditions must be favourable, since heavy initial expenditure is not justified. When liquid manure has to be carted, it is important that the distance shall be small. Temporary grass land, particularly where Italian rye-grass is a component of the mixture, responds most freely to liquid manure treatment.

The continued use of liquid manure develops coarseness in the grasses and this should be counteracted by the free use of phosphates and lime.

Poultry.—In very many cases poultry keeping on the general farm has been revolutionized during the last few years. The whole industry—including the specialist breeder, the large commercial poultry farmer and the general farmer—has made great progress since the War. Expansion is most noticeable on the general farm, where a few birds around the farm buildings, managed by some member of the farmer's household, have given place to large units distributed over the farm and managed by paid labour, and mainly devoted to egg production. The extension of grass land has made it possible to extend the poultry stock ; on clean land the poultry are

healthy and the grass land benefits from the consequent scratching and manuring.

In recent years there has been substantial progress on problems of breeding, feeding and prevention of disease. Breeders are trap-nesting their stock, and egg pedigrees are obtainable, in much the same way as milk yields are now part and parcel of the pedigree of dairy cattle. Feeding problems are constantly under investigation, and balanced rations suitable as to nutrients and bulk are in use. Some of the diseases affecting poultry are better understood, and means of prevention by testing to eliminate carriers of disease and inoculation to prevent disease, as well as better hygienic conditions of housing, are all having their effect on the success of the industry.

Hatching and rearing problems are not the least important. The specialist poultry farmer and the commercial poultry farmer usually make a feature of the day-old-chick trade as well as of eggs for hatching. The advent of battery brooding may modify the trade, and if intensive rearing for six weeks is proved successful, then a trade will develop for older birds fit to grow on without artificial heat. In the meantime, the general farmer can choose several methods of replenishing his stock. He can mate his own birds and produce his own hatching eggs, or he can purchase hatching eggs or day-old chicks or older pullets. In deciding to produce his own hatching eggs, he will have to consider the purchase of good strains of cockerels, selected not only for their individual merit but for their breeding for egg laying. The ideal mating would be trap-nested hens of good record and cockerels from proved layers.

Most farmers have not yet undertaken the trap-nesting of their hens, and rely on good cockerels to maintain and improve the egg-producing capacity of their flock. For the heavy breeds, early hatching is recommended ; the pullets begin to lay earlier and produce a greater number of eggs at the time when prices are at their best. Egg-laying trials promoted by County Authorities and other bodies indicate the possibilities when the birds are of the right strain, hatched moderately early, and housed and fed under good conditions.

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NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,
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Manures for Barley.—Numerous experiments have shown that the quality of barley is largely determined by soil and season, whereas the yield is considerably influenced by manures. Moreover, provided that fertilizers are not employed in such quantities that the crop is lodged, the larger crop thus grown will usually be of much the same quality as unmanured barley grown alongside. Indeed, if a considerable yield-increase is produced, the quality may be improved. The aim, therefore, is to manure for as large a crop as is likely to stand up at harvest under local conditions. Of the factors which make for yield, a supply of available nitrogen is one of the most important, and some of the results of experiments on the nitrogenous manuring of barley are collected in Table I below. The first series was that arranged under the auspices of the Institute of Brewing, and carried out from Rothamsted at a number of farms in different parts of the country over the period 1922–26. As a rule, single plots were employed, but these were large and the number of results brought together gives authority to the figures. In general, phosphate and potash were applied, so that the figures may also be regarded as the result of omitting nitrogen from the complete manure. In 1925, the effect of using nitrogen alone was also ascertained.

TABLE I
YEARLY AVERAGES. YIELDS BUS. PER ACRE

Year	*Number of centres*	*Yield without nitrogen*	*Increase for 1 cwt. sulphate of ammonia*
1922 ..	10	41·6	2·0
1923 ..	14	33·7	8·6
1924 ..	12	36·4	4·3
1925	8	32·7	7·1
1926 ..	13	35·8	1·0
Total ..	57	Mean 36·0	Mean 4·6

It will be seen that, over the series, the use of nitrogen has resulted in a gain of about 4½ bushels. The least satisfactory result was obtained in 1926 when, with a very small yield-increase, the quality of the barleys was depreciated by the nitrogenous manuring. In other years, this did not happen.

The question whether the presence of phosphate and potash is necessary to exploit the action of nitrogen to the full cannot be answered in a general way. In 1925, however, there was some evidence that, on well-farmed land, where abundant mineral manuring is given at other parts of the rotation, nitrogen exerts almost its full effect when used alone. The figures are given in Table II.

TABLE II
MEAN OF 10 CENTRES. 1925
Gain due to 1 cwt. sulphate of ammonia

Used alone	6·9 bus.
Used with phosphate and potash	7·4 ,,

The withholding of minerals, however, cannot be relied upon as a permanent policy, as the results (Table III) from the Hoosfield permanent barley plots show.

TABLE III
76 YEARS' AVERAGE. BUS. PER ACRE

	No minerals	*With minerals*
No manure	13·4	19·0
Sulphate of ammonia, 2 cwt.	23·7	39·3
Nitrate of soda, 2½ cwt. ..	24·3	37·7

Here the nitrogenous effect is approximately doubled by the addition of phosphates and potash.

On the individual farms of the series examined, cases have also occurred in which phosphate has been necessary to bring out the full effect of nitrogen. At Wellingore in Lincs, where experiments on the above lines are still in progress, this is the case. A recent set of results are given in Table IV.

TABLE IV
WELLINGORE, 1929. YIELDS BUS. PER ACRE

	Without phosphate and potash	*With phosphate and potash*
No manure	18·8	17·0
Sulphate of ammonia ..	19·5	24·1

The need, or otherwise, of phosphate and potash is, therefore, a local problem to be viewed in relation to previous manuring and the store of available minerals in the soil.

At Rothamsted, replicated experiments have been conducted on the nitrogen responses of barley over a period of years. In general, a basal dressing of phosphate has been supplied and this has frequently been justified. The yield-increases have been quite as satisfactory as in the series at outside centres quoted above. Confining attention to cases in which sulphate of ammonia, or its equivalent, has not been used in excess of 1½ cwt. per acre, the increase following the addition of nitrogen, calculated where necessary to the 1 cwt. basis, is given in Table V.

Concerning the type of nitrogenous manure many data have been collected comparing urea and ammonium chloride with sulphate of ammonia. The results are chiefly of interest in respect of synthetic fertilizer developments which are taking place on the Continent and elsewhere. Both these substances are

TABLE V

Year	Yield without nitrogen Grain in bus.	Yield without nitrogen Straw in cwt.	Increase for 1 cwt. sulphate of ammonia Grain in bus.	Increase for 1 cwt. sulphate of ammonia Straw in cwt.
1916 ..	33·8	20·7	7·9	5·8
1920 ..	36·7	22·4	3·5	3·1
1921 ..	26·1	17·6	5·6	3·9
1922 ..	25·2	16·7	5·7	4·2
1923 ..	21·1	14·8	3·2	2·1
1924 ..	23·8	14·1	9·7	5·6
1925 ..	38·6	19·1	9·5	3·8
1927 ..	23·6	15·4	11·2	4·9
1928 ..	28·6	24·4	6·0	6·4
Mean ..	28·6	18·4	6·9	4·4

very similar in their action to sulphate of ammonia, when used in equivalent amounts. Ammonium chloride, as a rule, gives somewhat higher quality, as measured by the nitrogen content, than does the more usual ammonium salt. In recent years the trials have included nitrate of soda and calcium cyanamide, and are therefore of more direct practical interest.

TABLE VI

ROTHAMSTED, 1928-29

		Single dose (23 lb. N) Grain in bus.	Single dose (23 lb. N) Straw in cwt.	Double dose (46 lb. N) Grain in bus.	Double dose (46 lb. N) Straw in cwt.
1928	No nitrogen ..	23·6	15·4	—	—
	Sulphate of ammonia	34·0	20·4	37·8	22·2
	Cyanamide ..	36·0	20·8	35·8	20·7
1929	No nitrogen ..	40·2	20·3	—	—
	Sulphate of ammonia	46·2	23·9	50·4	24·9
	Nitrate of soda ..	51·2	26·7	55·6	27·4
	Cyanamide ..	47·2	23·5	52·6	25·6

In these years, cyanamide and sulphate of ammonia have behaved very similarly, whereas, in the dry season of 1929, the nitrates gave definitely better results. In most cases, the double dose produced a small further increase in crop; but, on account of the danger of lodging and also of depreciating the quality of the grain, applications of this size will be unusual in practice.

In manuring barley which is to be undersown, attention should be paid to the effect of the fertilizers on the young seeds. Several observations have been made on this question. Phosphate and potash usually aid in the establishment of the clover constituents of the mixture, the former more particularly on heavy soils, the latter on light soil; on the clay loam at Rothamsted, potash has also notably helped the growth of young clover leys when applied to the nurse crop. On the other hand, the growth of seeds in wet seasons may be so strong

that the clover gives trouble in the sheaves at harvest time. Nitrogenous manuring tends to reduce the growth of clover, and this is most noticeable where the application has been heavy enough to grow much straw or lodge the crop. In ordinary amounts, the effect is probably not serious.

Nitrogen on Grass Land.—The intensive management of grass land by the rotational grazing of small enclosures, successively treated with quick-acting nitrogenous fertilizers, has received much attention in recent years. Not on all farms can such a system be adopted in its complete form, but there is no reason why certain valuable features, which have been observed where such a system has been carried into practice, should not be taken advantage of more generally, particularly since no special outlay or disturbance of the ordinary farm routine need be involved.

Hastening the growth of grass in spring is a case in point. Where nitrogenous fertilizers have been applied to grass land early in spring, vegetation begins distinctly earlier and proceeds more vigorously than on untreated land alongside. Valuable keep can frequently be obtained in this way ten days or a fortnight before the grass under ordinary treatment is fit for stocking, with no more outlay than is necessary to provide and apply the manure. One must not, of course, expect to get grass when the weather is totally unsuited to growth, but, as soon as more genial conditions set in, the treated land has everything in its favour and makes a rapid response.

About 1 cwt. of sulphate of ammonia is the usual application, and about the end of February would be a suitable time to give the dressing. Where it is convenient to give the manure still earlier in the spring, calcium cyanamide might be tried. If, on the other hand, the dressing is delayed, nitro-chalk would be in place.

In the full intensive system, an autumn dressing of phosphate and potash and, in some cases, of lime is recommended. Grass land in ordinary management will usually have been treated with mineral fertilizers in previous years, and, once in a way, a spring application of nitrogen may well be made without any special autumn preparations. If spring top-dressings are habitually given to the same field, this is a reason for generous treatment with minerals every three or four years.

* * * * * *

PRICES OF ARTIFICIAL MANURES

Description		Average prices per ton during week ended January 14				
		Bristol	Hull	L'pool	London	Cost per unit at London
		£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) ..	*	9 18*d*	9 18*d*	9 18*d*	9 18*d*	12 9
Nitro-chalk (N. 15½%) ..	*	9 7*d*	9 7*d*	9 7*d*	9 7*d*	12 1
Sulphate of ammonia :— Neutral (N. 20·6%) ..	*	9 8*d*	9 8*d*	9 8*d*	9 8*d*	9 2
Calcium cyanamide (N. 20·6%)	*	8 14*e*	8 14*e*	8 14*e*	8 14*e*	8 5
Kainit (Pot. 14%)	§	3 8	2 10	2 19	3 5	4 8
Potash salts (Pot. 30%) ..	§	5 6	4 8	5 0	4 19	3 4
,, (Pot. 20%) ..	§	3 17	3 0	3 8	3 12	3 7
Muriate of potash (Pot. 50%)	§	9 17	9 0	9 1	9 7	3 9
Sulphate,, ,, (Pot. 48%)	§	11 19	11 2	11 2	11 7	4 9
Basic Slag (P.A. 15¾%)‖ ..	§	2 13*c*	2 3*c*	..	2 9*c*	3 1
,, (P.A. 14%)‖ ..	§	2 7*c*	1 16*c*	1 16*c*	2 3*c*	3 2
,, (P.A. 11%)‖ ..	§	..	1 9*c*	1 9*c*	..	..
Ground rock phosphate (P.A. 26-27½%)‖	§	2 10*a*	..	2 9*a*	2 7*a*	1 9
Superphosphate (S.P.A.16%)	§	3 11	..	3 9	3 6	4 2
,, (S.P.A.13¾%)	§	3 5	2 18	3 3	3 0	4 4
Bone meal (N.3¾%, P.A.20½%)	§	8 15	8 10	8 2	6 12	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%)	§	5 19*b*	5 15*f*	5 15	4 7	..
Burnt Lump Lime	§	1 5*l*	1 2*m*	1 9	1 17*h*	..
Ground Lime	§	1 12*l*	1 8*m*	..	1 12*h*	..
,, Limestone	§	1 3*l*	1 6*g*	1 8*k*	..	..
,, Chalk	§	..	1 6*g*	..	1 11*h*	..
Slaked Lime	§	..	..	2 9	2 17*h*	..

Abbreviations: N.=Nitrogen; P.A.=Phosphoric Acid; S.P.A.=Soluble Phosphoric Acid; Pot.=Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 85%, through standard sieve.

a Prices for 4-ton lots f.o.r.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

g F.o.r. Knottingley. Ground limestone 100% through standard sieve.

h Carriage paid 6-ton lots London, bags included.

k In bags, f.o.r. Liverpool. Fineness 45% through standard sieve.

l Carriage paid 6-ton lots Bristol.

m Carriage paid 6-ton lots Knottingley.

* * * * * *

NOTES ON FEEDING STUFFS

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Minerals.—Numerous investigations are being made nowadays concerning the mineral content of rations. No useful purpose would be served by attempting here a survey of the whole field, for this is ever-widening and our present knowledge is very imperfect. The subject, however, is of some interest to farmers, and a few general considerations should constantly be borne in mind. Minerals resemble proteins to a certain extent, in being necessary for the maintenance of the animal body, in addition to being included in anything that the body makes, such as milk or new tissue. Hence the body must have a certain minimum if it is to achieve its greatest possible production, or even to keep in good health. Again, many minerals are included in the body, and the parts they play are not interchangeable so that excess of one cannot make up for the deficiency of another. The reverse is true, in fact, for it has been found that if large quantities of one mineral are consumed this may have the effect of leaching others from the body, and cause the appearance of conditions associated with deficiency where these would not otherwise appear. It follows that minerals resemble proteins in having a "biological value," which means that the value of any mineral added to the ration entirely depends on what the mineral balance of the ration was before. Here, however, the analogy with proteins stops short, for minerals are incapable of supplying any energy to the body, as can an excess of protein digestion products, and minerals can be stored up in the animal body to an appreciable extent, so that temporary deficiencies can be safely tided over, whereas the storage of proteins is extremely limited.

Minerals are distributed in small amounts all over the body, but the chief storage takes place in bone, into the composition of which they enter very largely. Bone contains much lime and phosphorus, so that the young animal, particularly a quick grower like the pig, needs fairly considerable quantities of these substances. This need is met by milk, the mineral content of which varies from species to species in accordance with the rate of growth, as illustrated by the table overleaf (taken from an article by Godden in *Agricultural Progress*, 1928).

The milk of a quick-growing species like the pig contains much protein (flesh-forming) and much ash, and, of the latter,

	No of days in which the wgt. of new-born animal is doubled	*Milk in species contains (per cent.)*				*Ash per 1,000 cals. (grammes)*
		Protein	*Lime (CaO)*	*Phosph. (P_2O_5)*	*Total Ash*	
Human	180	1·6	0·049	0·056	0·25	3·7
Cow ..	47	3·5	0·161	0·189	0·72	10·5
Pig ..	14	6·7	0·395	0·357	1·03	10·9

the larger proportion consists of lime and phosphorus (bone-forming, since bone consists chiefly of calcium phosphate). As early maturity (*i.e.*, quick growth) is one of the chief points for which stockbreeders are striving, it follows that mineral deficiencies are more liable to arise as livestock are improved. Thus the science of mineral nutrition is new, because it has only been seriously studied in recent years as the need for it became apparent. Its value lies more in the future, and it may be doubted whether we have yet reached the point at which it plays any considerable part in general husbandry.

Since milk contains the relatively high proportion of minerals shown above it is clear that the lactating animal should have a good supply, for if this is not provided in the ration it will be obtained by depleting the stores in the body—a process which cannot go on indefinitely. Pregnant animals, also, are using appreciable quantities of minerals in building up the bodies of their young, and this may have a serious effect on their own supplies, as is believed to happen quite commonly in humans.

In addition to these demands that the body may have to meet in different phases of its life, a certain minimum is necessary for its proper functioning. This is especially true of digestion, which can be absolutely stopped in a short time by complete absence of minerals. At this stage arises the comforting reflection that in practice minerals are never completely absent from the ration; in fact, it is probable that the vast majority of the animals of this country receive a sufficiency of them.

That, in particular districts, certain diseased conditions are occasioned by lack of minerals cannot be denied (Lamziekte, for instance, is prevalent in some parts of South Africa through shortage of phosphorus), but these are special cases of little or no importance to farmers in this country. From this point of view the subject of minerals belongs more to the veterinary profession, which must be in a position to diagnose these conditions correctly and to prescribe for them. Of greater interest to the farmer is the question whether reduced efficiency or lowered resistance to disease is commonly due to imperfect content, or balance, of minerals in the ration, and on this point

it is perhaps premature to dogmatize: many striking results have been obtained experimentally, but there is much contradiction in the literature. To be scientific, one must know the exact demands of the animal body for the different minerals under various conditions, as well as the actual content of the common feeding stuffs, so that foods can be combined to give the correct mineral mixture in the right amount. When it is realized that the mineral content of plants can vary widely according to the soils on which they are grown it can be seen how difficult a matter such mixing will be. Nor is that the whole story, for there is evidence that the amount of minerals absorbed by the animal from the food it eats does not depend entirely on the amount contained in the food, but is affected by the type of food—succulents are believed to contain a vitamin-like substance which raises the assimilation of lime, and sunlight also is thought to aid in a similar way.

At present farmers can do very little to feed their stock correctly as regards minerals, but they should keep in mind the possibility of lack of minerals being a cause of unthriftiness, or even sterility. If mineral deficiency or want of balance is suspected, it will usually be necessary to obtain expert advice, but a preliminary attempt to rectify matters might be made, in an experimental spirit, by changing the foods.

Milk has been described as a "protective" food, by which is meant that it contains all that is needful to the animal as regards protein (that is, the correct balance of amino-acids) and minerals; nevertheless, it is said to be lacking in iron in some districts. Linseed also has a good mineral content, but this food is not generally used in large quantities, being kept rather for special occasions, as in weaning, &c.; linseed cake is rich in phosphorus, but only fairly so in lime, and so is not by itself very well balanced, since these two should be present in approximately equal quantities. Bran (especially) and middlings are also quite rich in phosphorus, but they are poor in lime, as is true of oats and cottonseed meal. The foods most useful to balance up these (that is, those rich in lime and comparatively poor in phosphorus) are leguminous ones, especially lucerne and clover. A number of feeding stuffs contain very little in the way of minerals, and among these must be included mangolds, swedes, barley, maize, brewers' grains, and sugar-beet pulp; hay and grass are unknown quantities, since their composition is quite closely a reflection of the mineral content of the soil in which they are grown.

It will readily be realized that no attempt has been made here

to give a complete account of our knowledge of mineral nutrition. Nevertheless, it is hoped that with these considerations before him a farmer will conclude that it is unwise to add mineral mixtures indiscriminately to a ration. What is one man's meat is another man's poison, and what may be needed to supplement the mineral composition of one ration may only succeed in unbalancing another.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6·2	4 8
Maize	81	6·8	4 14
Decorticated ground nut cake	73	41·0	8 0
" cotton cake	71	34·0	7 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·15 shillings, and per unit protein equivalent, 2·05 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1930, issue of the Ministry's JOURNAL.)

FARM VALUES

Crops	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	5 2
Oats	60	7·6	4 5
Barley	71	6·2	4 14
Potatoes	18	0·6	1 2
Swedes	7	0·7	0 9
Mangolds	7	0·4	0 9
Beans	66	20·0	5 17
Good meadow hay	37	4·6	2 12
Good oat straw	20	0·9	1 5
Good clover hay	38	7·0	2 18
Vetch and oat silage	13	1·6	0 18
Barley straw	23	0·7	1 8
Wheat straw	13	0·1	0 15
Bean straw	23	1·7	1 10

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2. Price 6d. net.

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	6 5	0 11	5 14	72	1 7	0·85	9·6
Barley, British feeding ..	—	—	5 15	0 9	5 6	71	1 6	0·80	6·2
" Danubian	16 0	400	4 10	0 9	4 1	71	1 2	0·62	6·2
" Persian	15 0	"	4 3	0 9	3 14	71	1 1	0·58	6·2
" Russian	16 0	"	4 10	0 9	4 1	71	1 2	0·62	6·2
Oats, English, white	—	—	6 0	0 9	5 11	60	1 10	0·98	7·6
" " black and grey	—	—	5 10	0 9	5 1	60	1 8	0·89	7·6
" Canadian mixed feed ..	11 6	320	4 0*	0 9	3 11	60	1 2	0·62	7·6
" Argentine	12 6	"	4 7	0 9	3 18	60	1 4	0·71	7·6
" Chilian tawny	13 6	"	4 15	0 9	4 6	60	1 5	0·76	7·6
" German	20 3	"	7 2†	0 9	6 13	60	2 3	1·20	7·6
" Russian	15 0	"	5 5	0 9	4 16	60	1 7	0·85	7·6
Maize, Argentine	18 3	480	4 5	0 9	3 16	81	0 11	0·49	6·8
" South African	22 0	"	5 3†	0 9	4 14	81	1 2	0·62	6·8
Beans, English Winter ..	—	—	5 10§	1 2	4 8	66	1 4	0·71	20
Peas, English Blue	—	—	7 5§	0 19	6 6	69	1 10	0·98	18
" Indian	—	—	9 0†	0 19	8 1	69	2 4	1·25	18
" Japanese	—	—	15 10†	0 19	14 11	69	4 3	2·28	18
Dari	—	—	7 10	0 10	7 0	74	1 11	1·03	7·2
Milling offals—									
Bran, British..	—	—	5 12	1 0	4 12	42	2 2	1·16	10
" broad	—	—	6 15	1 0	5 15	42	2 9	1·47	10
Middlings, fine, imported ..	—	—	5 17	0 15	5 2	69	1 6	0·80	12
" coarse, British ..	—	—	5 12	0 15	4 17	58	1 8	0·89	11
Pollards, imported	—	—	4 15	1 0	3 15	60	1 3	0·67	11
Meal, barley	—	—	5 17	0 9	5 8	71	1 6	0·80	6·2
" maize	—	—	6 2	0 9	5 13	81	1 5	0·76	6·8
" " South African ..	—	—	5 15	0 9	5 6	81	1 4	0·71	6·8
" " germ	—	—	5 15	0 14	5 1	85	1 2	0·62	10
" locust bean	—	—	5 12	0 7	5 5	71	1 6	0·80	3·6
" bean	—	—	8 15	1 2	7 13	66	2 4	1·25	20
" fish	—	—	18 10	2 18	15 12	53	5 11	3·17	48
Maize, cooked flaked	—	—	6 15	0 9	6 6	83	1 6	0·80	8·6
" gluten feed	—	—	6 7	0 18	5 9	76	1 5	0·76	19
Linseed cake, English, 12% oil	—	—	9 12	1 6	8 6	74	2 3	1·20	25
" " " 9% "	—	—	9 1	1 6	7 15	74	2 1	1.12	25
" " " 8% "	—	—	8 17	1 6	7 11	74	2 0	1·07	25
Soya bean cake, 5½% oil ..	—	—	7 17*	1 17	6 0	69	1 9	0·94	36
Cottonseed cake—									
" " English, 4½% oil	—	—	4 12	1 5	3 7	42	1 7	0·85	17
" " Egyptian, 4½% "	—	—	4 0	1 5	2 15	42	1 4	0·71	17
Decorticated cottonseed meal, 7% oil	—	—	9 5*	1 17	7 8	74	2 0	1·07	35
Ground-nut cake, 6-7% oil ..	—	—	5 15*	1 5	4 10	57	1 7	0.85	27
Decorticated ground-nut cake, 6-7% oil	—	—	8 0	1 18	6 2	73	1 8	0·89	41
Palm kernel meal, 1-2% "	—	—	4 17	0 16	4 1	71	1 2	0·62	17
Feeding treacle	—	—	5 15	0 8	5 7	51	2 1	1·12	2·7
Brewers' grains, dried ale ..	—	—	4 5	0 16	3 9	48	1 5	0·76	13
" " " porter ..	—	—	3 17	0 16	3 1	48	1 3	0·67	13
Malt culms	—	—	5 0†	1 5	3 15	43	1 9	0·94	16
Dried sugar beet pulp (a) ..	—	—	4 10	0 8	4 2	65	1 3	0·67	5·2

* At Bristol. † At Liverpool. § At Hull. (a) Carriage paid on 4-ton lots.

NOTE.—*The prices quoted above represent the average prices* at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of December, 1930, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel cake is offered locally at £7 per ton, then since its manurial value is 16s. per ton as shown above, the food value per ton is £6 4s. Dividing this figure by 75, the starch equivalent of palm kernel cake as given in the table, the cost per unit of starch equivalent is 1s. 8d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0·89d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices :—N., 8s. 3d.; P_2O_5, 2s. 11d.; K_2O, 3s. 8d.

MISCELLANEOUS NOTES

Wart Disease Immunity Trials, 1931

DURING the coming season, the Ministry will continue to test potatoes and potato seedlings, as hitherto, in regard to their immunity from or susceptibility to wart disease. The tests will be carried out at the Potato Testing Station of the National Institute of Agricultural Botany at Ormskirk on the conditions stated below.

The entry form (No. 345 H.D.), obtainable from the Ministry, should be filled up and returned to the Potato Testing Station, Ormskirk, Lancs., *with the requisite fees.* Samples must be sent to that Station *as early as possible, but in any case not later than March* 1.

Potatoes are accepted *from English, Scottish and Irish growers* for trial under the following conditions :—

(*a*) Quantity of each stock of Potato to be sent for the first time —50 seed size tubers.

Quantity of each stock of Potato to be sent for the second and for subsequent years—35 seed size tubers.

(*b*) Fees on the following scale are payable in respect of each stock of Potato when first entered for immunity trials :—

Less than 5 samples from one grower	10*s*. per sample.
5 samples or more from one grower	8*s*. per sample up to 20, and 6*s*. for each sample in excess of 20.

These fees are not returnable under any circumstances.

(*c*) The Ministry, while taking reasonable precautions to secure satisfactory growth, can accept no responsibility for the failure of any variety.

(*d*) The Ministry will take all reasonable precautions to secure that all the produce of the trial plots is fed to stock after being thoroughly mixed together, except such portions as may be needed for exhibition or scientific purposes authorized by the Ministry. The Ministry, however, reserves the right to send tubers from the produce grown at Ormskirk for testing at the official stations of the Department of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland.

(*e*) All stocks entered for the trials will be tested both in the laboratory and in the field. When the Ministry is satisfied as a result of the trials that a variety is immune from Wart Disease, it will formally "approve" the variety and will issue an official certificate of immunity. Such certificates will not be issued until the variety has been named and until an assurance has been received from the sender that it has been, or is about to be, introduced into commerce. *When a variety tested under a number or letter has been subsequently named and "approved," a sample of* 100 *tubers of the variety as named must be sent to Ormskirk for comparison with the tested stock.* No certificate will be issued for any new variety until it has passed at least two consecutive years' tests without contracting the disease, and has been declared by the Synonym Committee of the National Institute of Agricultural Botany to be distinct from existing varieties.

Potatoes are accepted *from foreign growers* on the conditions (*a*) to (*d*) set out above, but no foreign variety will be formally "approved" and no certificate will be issued until the variety is definitely introduced into commerce in Great Britain.

Trials of Seedlings.—The Ministry desires to encourage the breeding of new varieties of potatoes, and in order to provide information for breeders of seedlings it is prepared to accept not fewer than two tubers, and not more than ten tubers, of any seedlings for testing in the laboratory and growing for one season on the trial plots, and to furnish a report on the results obtained, without payment of a fee. These tests, however, will not be considered as forming part of the Immunity Trials proper and will not be reckoned in the minimum period of two years referred to under (*e*). The results of these tests will not be included in any report issued by the Ministry.

GENERAL INSTRUCTIONS : *Carriage.*—Small consignments should be sent by passenger train, carriage paid, or by parcel post ; larger consignments should be forwarded by goods train, carriage paid.

Labels.—All consignments should be distinctly labelled. A label bearing the name and address of the sender and name of variety or seedling number should be firmly tied to the bag ; in addition a similar label should be placed inside the bag.

Address.—All consignments should be addressed to :—

THE SUPERINTENDENT,
POTATO TESTING STATION,
NATIONAL INSTITUTE OF AGRICULTURAL BOTANY,
ORMSKIRK, LANCS.

Station : Ormskirk, L.M. & S. Railway.

Date of Forwarding.—Consignments should be sent so as to reach the Testing Station as early as possible and in any case not later than March 1.

* * * * * *

The Agricultural Index Number

THE index number of the prices of agricultural produce during December was 26 per cent. above the level of the base years, 1911–13, as compared with 29 per cent. and 43 per cent. a month and a year earlier, respectively. While the index numbers of nearly all descriptions of produce showed a fall, the main factors in the drop of three points in the general figure were the lower indices recorded for grain, fat cattle and fat sheep, although these reductions were partially offset by an increase in the index for milk.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1925 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1925	1926	1927	1928	1929	1930
January	71	58	49	45	45	48
February	69	53	45	43	44	44
March	66	49	43	45	43	39
April	59	52	43	51	46	37
May	57	50	42	54	44	34
June	53	48	41	53	40	31
July	49	48	42	45	41	34
August	54	49	42	44	52	35
September	55	55	43	44	52	42
October	53	48	40	39	42	29
November	54	48	37	41	44	29
December	54	46	38	40	43	26

Grain.—Values for grain receded further, the averages for wheat, barley and oats falling by 7*d.*, 1*s.* 2*d.* and 3*d.* respectively per cwt. The index figures for wheat and oats were six and three points lower on the month at 17 per cent. and 20 per cent. below 1911–13, while in the case of oats a reduction of 11 points was recorded, and this fall brought oats to precisely the pre-war level. As compared with the corresponding period a year ago wheat was cheaper on average by 3*s.* 4*d.* per cwt., barley by 7*d.* and oats by 1*s.* 7*d.*

Live Stock.—Prices of fat cattle were a trifle higher in December than in the preceding month, but as the rise was proportionately much smaller than in the base years, the index number fell by eight points to 20 per cent. above 1911–13. Similarly, although quotations for fat sheep were practically unchanged, the index figure was nine points lower at 44 per cent. in excess of the base level. In December, 1929, fat cattle averaged 30 per cent. and fat sheep 53 per cent. above 1911–13. Bacon pigs failed to maintain the slight rise in price recorded during November, and the index figure declined by three points to 26 per cent. above 1911–13. On the other hand, porkers were three points higher at 53 per cent. over pre-war. Dairy cows and store cattle showed little change either in price or index number. Values for store sheep were a little higher, but the index number was six points lower at 50 per cent. in excess of the base years. Quotations for store pigs receded somewhat, and the index figure declined by seven points to 104 per cent. above pre-war.

Dairy and Poultry Produce.—During the month under review, the contract price of milk in most districts was rather higher than in November, with the result that the average rose by about ¾*d.* per gallon, and the index number by eight points to 65 per cent. over 1911-13. Butter prices showed a little recovery

from the recent low levels, and the index advanced by two points to 12 per cent. above pre-war, while cheese was practically unaltered, the index remaining at 16 per cent. in excess of 1911–13. Eggs were 5½*d.* per dozen cheaper, and the index number fell by 19 points to 14 per cent. in excess of the base level. A year ago eggs were 47 per cent. dearer than pre-war. Quotations for poultry were rather higher, on account of the seasonal demand, but the increase in price was much less pronounced than in the base years, and the index figure was five points lower on the month.

Other Commodities.—Potato prices continued to advance during December, and the index number rose by three points to 49 per cent. over pre-war, which compares with only 10 per cent. at the corresponding period a year earlier. Hay showed no change either in price or index number. Apples were dearer than in November at 44 per cent. over 1911–13, but vegetables were cheaper as a rule at an average of 27 per cent. over pre-war. Values for wool were again slightly lower at 19 per cent. less than in pre-war years.

Index numbers of different commodities during recent months and in December, 1928 and 1929, are shown below :—

Percentage increase as compared with the average prices ruling in the corresponding months of 1911-13.

Commodity	1928	1929	1930			
	Dec.	Dec.	Sept.	Oct.	Nov.	Dec.
Wheat	31	28	—3*	—7*	—11*	—17*
Barley	24	7	3	13	11	Nil
Oats..	29	2	—12*	—12*	—17*	—20*
Fat cattle	27	30	35	31	28	20
,, sheep	50	53	62	62	53	44
Bacon pigs	26	64	33	25	29	26
Pork ,, ...	36	77	44	45	50	53
Dairy cows..	34	31	31	30	31	30
Store cattle..	21	17	27	27	23	22
Store sheep..	49	48	69	62	56	50
Store pigs	30	108	107	107	111	104
Eggs	37	47	36	56	33	14
Poultry	45	34	40	39	36	31
Milk	71	67	100	47	57	65
Butter	50	45	24	14	10	12
Cheese	79	32	22	17	16	16
Potatoes	45	10	51	40	46	49
Hay	8	41	11	—4*	—7*	—7*
Wool	66	39	—8*	—12*	—17*	—19*

* Decrease.

Enforcement of Minimum Rates of Wages.—During the month ending January 14, legal proceedings were instituted against four employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board. Particulars of the cases are as follows :—

County	Court	Fines £	s.	d.	Costs £	s.	d.	Arrears of wages £	s.	d.	No. of workers involved
Lancaster ..	Warrington	1	0	0	0	5	0	6	10	0	1
Yorks E.R. ..	Hull ..	2	2	0	—			15	4	7	2
„ W.R...	Rotherham	0	8	0	1	1	0	17	11	8	1
Glamorgan ..	Pontardawe	1	0	0	2	2	0	8	4	4	1
		£4	10	0	£3	8	0	£47	10	7	5

* * * * * *

APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Lincolnshire (Holland) : Mr. F. W. Handley, B.Sc., Ph.D., Assistant Agricultural Chemist, has been promoted Agricultural Chemist, *vice* Mr. M. N. Nicholson, B.Sc., A.I.C.

Mr. E. R. Wallace, B.A., has been appointed Agricultural Mycologist, *vice* Mr. W. F. Cheal, D.I.C., N.D.A.

Nottinghamshire : Mr. K. D. R. Davis, M.A., has been appointed Assistant Agricultural Organizer, *vice* Mr. A. Voysey, B.Sc.

Somersetshire : Miss M. L. Mann, N.D.P., has been appointed Assistant Instructress in Poultry-keeping, *vice* Miss N. Collier, N.D.P.

Sussex (West) : Miss E. G. Stoward, N.D.P., has been appointed Instructress in Poultry Husbandry, *vice* Mr. F. A. Kent, N.D.P.

Warwickshire : Mr. P. Cragg* has been appointed Assistant Instructor in Horticulture, *vice* Mr. C. R. S. Gregory, N.D.H.

Yorkshire (Agricultural Department, University of Leeds): Mr. D. Witney, B.Com., has been appointed Assistant Lecturer in Agricultural Economics, *vice* Mr. V. Liversage, B.Sc., N.D.A.

* Wholly employed by the County Council, but only partially on agricultural education work.

WALES

The announcement, in the January, 1931, issue, of the appointment of officers in the County of Glamorgan is amended to read as follows :—

Glamorganshire: Mr. Frederick Blakemore, M.R.C.V.S., Instructor in Veterinary Science.

Mr. E. Ll. Harry, B.Sc. (Agric.), Instructor in Agricultural Economics.

Mr. William Williams, M.Sc. (Agric.), Instructor in Agriculture.

Mr. H. R. Jenkins, N.D.P., Instructor in Small Live Stock.

Mr. William Evans, N.D.P., Instructor in Poultry Husbandry.

The following further appointments are notified :—

Denbighshire : Mr. Emrys Davies, B.Sc. (Wales), has been appointed as Assistant Organizer and Lecturer in Agricultural Science, *vice* Mr. J. S. Roberts, temporarily acting in this capacity.

Monmouthshire : Mr. C. H. King has been appointed Assistant Poultry Instructor, *vice* Mr. F. R. Wallbutton who resigned to take up an appointment in Somersetshire.

NOTICES OF BOOKS

History of the British Friesian Cattle. Pp. 552. (London : British Friesian Cattle Society, 11 Southampton Row, W.C. 1. Lewes : W. E. Baxter, Ltd. Price 7s. 6d.)

From time to time, notably during the seventeenth and eighteenth centuries, native British breeds of cattle have been considerably modified by imported Dutch stock. In addition, large numbers of cows were brought over from Holland during the "seventies" and "eighties" of last century. Further importations have taken place in recent years, with results which are visible in the British Friesian cattle of to-day. All that is known concerning the history of the breed is here given, together with information concerning pedigrees and performances, and a history of the British Friesian Cattle Society from its foundation, in 1909, down to the present date. The book should be of service to cattle breeders and milk producers, as well as to students of agricultural history.

Vocational Education in Agriculture. International Labour Office Studies and Reports : Series K (Agriculture), No. 9. Pp. vii + 244. (London : P. S. King & Son, Ltd. Price 5s.)

With the object of obtaining information likely to prove useful to authorities interested in the vocational education of rural populations, the International Labour Office some six years ago addressed a questionnaire to all States Members of the International Labour Organization. The report is based on replies received from 32 countries, in most cases accompanied by reports of agricultural and educational departments, texts of laws, periodicals, pamphlets and other annexes. Part I defines and classifies various systems of vocational agricultural training. In the rest of the book is given detailed information regarding the facilities for agricultural education existing in the countries which have supplied data.

The Agricultural Extension System of the United States. By C. B. Smith, M.S., D.Sc., and M. C. Wilson, B.S. Pp. x + 402. (New York : J. Wiley & Sons, Inc. London : Chapman & Hall, Ltd. Price 17s. 6d. net.)

The agricultural extension system of the United States entails an annual expenditure of some $23,000,000, and employs nearly 6,000 federal, state and county officials, co-operating with approximately 250,000 volunteer workers and a million and a-half "farm and home" demonstrators. The work upon which they are engaged, some of the results which have been achieved, and the programme for the future are described in this volume with the aid of numerous figures and graphs.

The Agricultural Note-Book. By P. McConnell, B.Sc. 11th edition. Pp. xi+540. (London : Crosby, Lockwood and Son, 1930. Price 15s. net.)

The first edition of this well-known work of reference was published in 1883 and the tenth in 1922. Developments in agricultural science and practice during the past eight years have necessitated adjustment and additions on some 250 pages of the present edition. The most important alterations will be found in the sections dealing with sugar beet, soils and manures, plant diseases, dairy rations, milk standards, livestock points, livestock diseases, poultry breeding, livestock and fruit pests. Everybody concerned in agriculture should find the book of service.

Index to the Literature of Food Investigation. Vol. II, Nos. 1 and 2. (London: His Majesty's Stationery Office. 1930. Price 2s. net each.)

Three years ago, the Imperial Research Conference recommended that research institutes throughout the Empire should forward their publications on the preservation and transport of food to the Low Temperature Research Station at Cambridge, which in its turn should issue to such research institutes periodical bibliographies of the subject. So far, four indexes have been issued, each containing a list of published papers arranged under subject headings. The preface to the present volume details the more noteworthy developments which occurred during the year 1928-1929.

East Yorkshire: A Study in Agricultural Geography. By S. E. J. Best, B.Sc., Ph.D., F.R.G.S. Foreword by G. B. Fawcett, D.Sc. Pp. xv+189. (London: Longmans, Green and Co. Price 16s. net.)

A regional survey of a rural area. Following a preliminary discussion of the physical features and geological formation of the area, the author delimits 13 soil regions, which are correlated with the distribution of crops and population. Fluctuations in population are illustrated by a series of graphs, crop distribution by tables, diagrams and maps. An interesting chapter is devoted to the agricultural history of the district, and the survey concludes with a picture of the East Riding of to-day.

Crop Production and Management. By J. F. Cox. 2nd ed. Illustrated. Pp. xii+469. (New York: J. Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Price 13s. 6d.)

Since its first publication, in 1924, this book has been used extensively by agricultural institutes and experimental stations in the United States of America. The original title included a reference to "Soil Management," a subject concerning which so much has been written during the past six years that detailed discussion was deemed unnecessary in the present revision. Special emphasis is laid on the methods employed by successful farmers in the northern and corn-belt States. Throughout the book, American practice is implied, and for this reason its appeal to the British agriculturist must be largely academic.

Agricultural Co-operation in England: A Survey by the Horace Plunkett Foundation. Pp. viii+272. (London: George Routledge & Sons, Ltd. Price 7s. 6d. net.)

Sir Horace Plunkett's achievements in regard to agricultural co-operation form a classic chapter in the economic history of the British Isles. The Foundation which bears his name aims at supplying to the interested public all available information on the subject by means of a Year Book, supplemented by occasional volumes dealing with the development of co-operative practice throughout the world. The present survey appears at an opportune moment, when an Agricultural Marketing Bill is being discussed in Parliament and National Mark Schemes are encouraging co-operative effort in various branches of the industry. In a foreword, Sir Horace describes the survey as "an account of a very substantial achievement, a complete answer to the common cry that farmers cannot or will not organize." The book gives evidence, "which few may have suspected, of real vitality in the farming community." We are told that there are in England alone 230 societies, comprising 67,526 members, with 97,467 customers, a share capital of £1,117,727, and a total turnover in 1929 of £9,800,230. Of every 100 English farmers 19 are members of an agricultural co-operative society, while 28 do at least part of their business with a society.

Brief chapters on the history of the movement and on the structure of existing societies are followed by a survey of all England by counties; each section contains detailed information concerning all known agricultural co-operative organizations in a particular county, their special purpose, membership and financial results. Most progress appears to have been made in the purchase of requirements such as manures, seeds and feeding stuffs. Whereas the turnover from the sale of farm produce of various kinds in the year 1929 was £2,910,484, the corresponding figure for agricultural requirements amounted to £6,889,746. Consumers' societies would seem to be typical of the movement in England, as are creameries in Ireland and credit societies in central Europe.

Of more recent and sporadic growth are marketing societies. Milk was one of the first commodities to engage attention. Less progress has been made with livestock, meat, fruit and wool. Egg marketing has received a strong stimulus from the introduction of the National Mark.

The survey concludes that prospects are by no means discouraging. While still insufficiently consolidated, the movement has passed through a series of crises including the post-war boom years, the ensuing slump, the failure of the Agricultural Wholesale Society, the cessation of the Agricultural Organization Society, and, more recently, the steep decline in prices. A system which can survive in such circumstances certainly gives evidence of vitality.

This is no mere "work of reference," but an up-to-date manual on co-operation.

Judging Poultry for Production. By J. E. Rice, G. O. Hall and D. R. Marble. Pp. xii + 425. Illustrated. (New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Price 18s. 6d. net.

Poultry judging may be said to have begun with poultry keeping. At first, selection was based mainly on the fighting qualities of the cocks, but the sense of beauty early expressed itself in a desire to breed birds of gay plumage and striking type. In the nature of things, just when and how food values became the dominant objectives in the choice of birds must remain an insoluble mystery, but it is significant that Columella and Stephanus, who wrote, respectively, in the first and sixth centuries A.D., both attached importance to physical characters indicative of egg and flesh production. The invention of the trapnest ushered in an entirely new epoch in the poultry industry, and with it an entirely new science and art of judging in which physical examination has taken a place as an essential part of the procedure.

The present volume assembles and classifies the most recent data regarding judging for vitality and production, as well as the relation of these to the selection of fancy birds. There are chapters on the influence of heredity and environment, on constitutional vigour, physiology, pigmentation, moulting, the head, body-type and internal anatomy, all considered in relation to productivity, while the practice of culling and selection receives extensive treatment. There are numerous illustrations and tables, a bibliography which is probably exhaustive so far as America is concerned, and a good glossary. As might be expected in an American publication, Part III concerning educational facilities in poultry judging refers exclusively to transatlantic institutions and methods. Other sections would require some adaptation in the light of conditions on this side. This apart, the book contains a large amount of information that should prove useful to the British poultry-keeper and judge.

Size and Form in Plants. By F. O. Bower, Sc.D., LL.D., F.R.S. Pp. xiv + 232. Illustrated. (London: Macmillan & Co., Ltd. Price 12s. 6d. net.)

Why has a given plant certain dimensions; why cannot it appear as a magnified or reduced image, say, ten times or one-tenth of its normal size? Sachs in his essay on size-relation, published in 1893, pointed out that a correlation existed between dimension and organization which rendered this mechanically and physically impossible, and he proceeded to illustrate this position by reference to cellular construction. The present discussion of the subject is based rather on the morphology of tissue-masses. Professor Bower draws upon his comprehensive knowledge of the Vascular Cryptogams in some of which morphoplastic problems can be studied without the complication of secondary growth, and with the aid of singularly clear figures and tables he demonstrates the intimate association of increasing complexity and increasing size. Physiologist and morphologist alike should find this study stimulating and provocative.

Progress in English Farming Systems. IV.—*Another Departure in Plough Farming.* By C. S. Orwin. Pp. 16. (London: Humphrey Milford, Oxford University Press. 1930. Price 1s. net.)

This study describes the agricultural experience of Mr. F. P. Chamberlain, who entered upon the tenancy of Crowmarsh Battle Farm in Oxfordshire in 1894, in which year the average price of wheat fell to the lowest point of the century. The holding is 550 acres in extent, arable with the exception of 10 acres occupied by buildings and roads, 40 acres of pasture and 65 acres planted in recent years with fruit. The previous occupier had farmed on the local system of corn and stock—bullock feeding and hurdle sheep—but Mr. Chamberlain introduced a milking herd of between 50 and 60 non-pedigree Shorthorns and dispensed with the sheep. Some 21 years ago, however, in the light of experience gained on the farms, he decided to concentrate entirely on the production of arable crops, the only live stock he retained on the farm being 10 horses. No rotation is observed, cropping being determined solely by the nature of the soil and the cleanliness of the land. All crops are sold off the farm. To maintain fertility and humus, reliance is placed on artificial manures and the turning in of second-growth clover: cleanliness of the land is maintained by a fallow. The regular labour force is stabilized at 11 men. Until the end of 1926, Mr. Chamberlain depended upon the hire of steam tackle for ploughing and cultivation, but during the past three years tractors and tractor implements have been acquired for all tillage purposes; two horses have been sold and the cable ploughs dispensed with. Although the area under cultivation is insufficient to keep two tractors in constant employment, Mr. Chamberlain estimates that the introduction of tractors has reduced his mechanical cultivation costs by some £50 per annum. It is said to be largely due to this mechanization that a return on capital has been made during the period 1923/4-1928/9.

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NOTES FOR THE MONTH

Laying Down Land to Grass

A CONFERENCE on "The Making of New Grass Land" was held at the Rothamsted Experimental Station on February 11. There was a large gathering of farmers and agricultural officers from many parts of the country, and Sir Daniel Hall took the Chair. All connected with farming are aware of the large amount of useful knowledge that is stored in the minds of thoughtful and observant farmers. Much of it would be quite unavailable were it not for meetings such as that under notice. Seven of the nine papers read had been prepared by farmers who had put down considerable areas of land to grass in their respective districts with marked success. As the localities dealt with ranged from wet districts in the North of Scotland to the drier parts of the Eastern counties, it was not surprising that very sharp differences of opinion existed in regard to the most suitable varieties of grasses and clovers, and the correct lines of management in the critical early years of the pasture. There were, however, different views on matters of cleanliness of seed bed and surface cultivation which were not so easily explained by local conditions, and the many points of this kind that were raised at the Conference might well be critically examined by experimenters.

The papers formed a very valuable record of experience and they will be published in due course.*

Mr. James Cruickshank (Aberdeen) described the system whereby he had transformed a poor clay arable farm into excellent temporary and permanent grass. Simple mixtures were sown under a light crop of barley and generously treated with slag or rock phosphate. For the first two years early hay crops were taken to prevent poaching this heavy soil in wet weather.

* Rothamsted Conferences, No. 11. Ernest Benn, London, 1931. (In preparation.)

Mr. Findlay (North of Scotland College of Agriculture) gave an interesting account of his work on varieties and strains of grasses and clovers. It was clear from other papers that this work had greatly influenced local farming.

Major James Keith (Aberdeen) spoke of the striking improvement in his temporary leys that had followed the introduction of wild white clover. He described his efforts to utilize the fertility put into the land when these leys were broken up, and found it best to take two root crops on such land before coming into cereals.

Captain A. R. McDougal (Berwickshire) set out the methods whereby he had improved a large area of worthless grass, much of it at high altitudes. Manuring had been useless, and ploughing out and re-seeding was his solution. Capt. McDougal has employed observation plots of grasses and clovers on his uplands for many years and based his mixtures on the results.

Coming now to the Eastern Counties, Mr. W. S. Mansfield (Cambridge University Farm) dealt with the question of laying heavy soils to grass under light rainfall. The introduction of wild white clovers had greatly assisted what was formerly a difficult task. The strain and quality of the wild white clover seed must, however, be of the best. Close, even grazing in the first year with mixed stock or with sheep was the most rapid method of establishing a sole in a new pasture. The common practice of haying in the first year postponed the formation of a close bottom.

Mr. J. Alston (Norwich) always aimed at sowing on clean land in good heart; like the previous speaker he used simple mixtures with a good seeding of wild white clover and grazed in the first year. Cocksfoot was an essential species for early keep on light land.

Several novel practices that had worked well on his land were mentioned by Mr. C. H. Gardner (Bedfordshire). The new pastures were not fenced off from the old, and were manured and reseeded (through the cattle) from the rich old pastures. Light seedings were used in the first instance. Harrowing was unnecessary as his fields were always adequately stocked and trodden: furthermore, harrowing tended to destroy seedlings in the manure.

[*Mr. Gardner farms near the chalk and, in such circumstances, the grass sod is generally free from "mat."*]

Mr. A. McArthur (Hertfordshire) described how he had established 20 acres of excellent grass. His main species were wild white clover and perennial ryegrass. Cocksfoot, so well

spoken of by others, he did not use because it was distasteful to stock.

Mr. Martin Jones (Imperial Chemical Industries) dealt with the question of strains of pasture plants in relation to their leafiness and persistence, and showed how it was possible, by suitable grazing and manuring, to utilize the quick-growing varieties in the early years without repressing the perennial species that were to form the basis of the permanent pasture.

Several points stood out on reviewing the papers and subsequent discussion; in particular the leading places of wild white clover and phosphatic manuring in grassland farming; the value of indigenous strains of grass and clovers; and the importance of good after-management.

* * * * * *

Sugar-Beet Growing in 1931

THE following statement was made by the Prime Minister in the House of Commons on February 12:—"The Government have given careful consideration to the position of the sugar-beet industry. In view of the general industrial situation, the Government have, naturally, been most reluctant to consider the grant of additional aid to an industry which is already subsidized. But the position which has resulted from the unprecedented fall in sugar values, to a figure far below pre-war values, in a year when the statutory rate of subsidy will be halved, is so exceptional that they have decided, subject to the approval of Parliament, to offer a special advance to the industry for one year only, the advance to be deducted, in the event of sugar prices rising substantially, from the normal subsidy which will be due in the last two years of the subsidy period. The amount of the special advance is to be limited to 1s. 3d. per cwt. of sugar, payable on 300,000 cwt. of sugar (ex 98°) manufactured per factory in the 1931-32 campaign, and is to be payable on the following conditions:—

"(i) A firm price to be offered by factories to farmers which shall give them the full equivalent of the special advance and, generally speaking, shall require from factories in 1931-32 a maximum sacrifice of provision for depreciation and other capital charges, profit and additions to reserves.

"(ii) All beet contracts offered by farmers to be accepted by factories up to their throughput capacity as defined by the Minister of Agriculture and Fisheries, and the whole

of the contracts of each factory to be on the same terms as to price.

"(iii) The special advance to be contingent upon the price of sugar during the 1931-32 manufacturing campaign, that is to say, if the price of raw sugar (96°) rises above 6s. 6d. per cwt. c.i.f. United Kingdom, the amount of special advance promised shall be abated by the amount of the rise in sugar prices.

"About two-thirds of the factories have already accepted the Government's proposal and have decided, in consequence, to offer farmers a price of 43s. per ton for beet of 17½ per cent. sugar content. At the moment I am unable to give the House any further information as to the results."

* * * * * *

Cereal Smuts

SMUT diseases are responsible for very considerable loss of cereal grain in this country every year, bunt of wheat in particular being the cause of loss of many thousands of bushels annually. The damage done is to be measured, not only by the amount of grain actually destroyed, which is often very large, but also by the diminished value of the healthy grain, which becomes blackened and contaminated by the spores that adhere to its surface.

Since it is possible, by fairly simple methods and at very moderate cost, either to avoid all loss caused by a given smut disease or to reduce the loss to a minimum, the Ministry has prepared a Bulletin* to guide farmers as to the means that are at their disposal to combat these troublesome diseases. Mention is made of the use of dry copper carbonate for the treatment of wheat against bunt, and it is suggested that this comparatively new method is worthy of extended trial. The diseases dealt with are bunt of wheat, loose smut of wheat, covered smut of barley, loose smut of barley, and covered and loose smuts of oats. The book is printed in clear type on good paper, and is well illustrated.

* * * * * *

Fowl Pox Vaccine

THE Ministry wishes to notify poultry farmers that it is now issuing a vaccine for Fowl Pox (avian diphtheria; diphtheritic roup; canker) at a charge of 1d. (one penny) per dose, to cover the cost of production. There will be a minimum charge of 2s. 6d. (two shillings and sixpence), this sum covering the supply of 30 doses of the vaccine and an instrument and brush for its application.

* Bulletin No. 24, *Cereal Smuts and Their Control*, price 5d., post free from the Ministry.

The vaccine has been extensively tested in the field during the past 15 months; during that period, some hundreds of thousands of fowls have been inoculated, with very satisfactory results. The vaccine confers a solid immunity of at least four months' duration; it is free from danger; it causes no constitutional disturbance; and it does not interfere with egg production.

In order to keep down the cost of production and avoid unnecessary clerical work, *cash must be enclosed with each order*. Orders should be addressed to The Director, Ministry of Agriculture and Fisheries, Veterinary Laboratory, New Haw, Weybridge, Surrey. Cheques, money orders and postal orders should be made payable to "The Ministry of Agriculture and Fisheries" and crossed "Bank of England."

* * * * * *

Varieties of Potatoes

THE following note has been communicated by the National Institute of Agricultural Botany, Cambridge. Among potatoes, more than in the case of any other farm crop, the difficulty of making definite recommendations of varieties is very great. This arises mainly from the confusion in naming which has existed until recent times. It would be quite impossible for any organization to test on a field scale all the so-called varieties which have been offered to the public. The Potato Synonym Committee of the National Institute of Agricultural Botany has, however, proved in the past few years that the number of genuine varieties—re-named again and again—is comparatively limited. Most of the *bona fide* potato varieties of commercial importance have been submitted to very accurate cropping tests by the Institute at its Potato Testing Station at Ormskirk, or, in co-operation, by the Agricultural Institute and Experimental Station at Kirton, near Boston, or by the Cornish County Council at Truro.

Potato growers should realize that whatever varieties they grow and however skilfully they may grow them, their efforts may be brought to naught by the use of unhealthy "seed." The best variety, if badly infected with virus diseases such as Leaf-roll or Mosaic, may give a poorer return than that obtained from healthy "seed" of an inferior variety. The best guarantee of health is to purchase only from firms of established reputation, and to refrain from planting "seed" grown in the south for more than two years.

Information concerning sprouting, manuring, spraying and

other cultural points is readily available to growers. It is, however, worthy of mention that the cutting of "seed," if carefully carried out, is an economy which has no deleterious effect on the crop; that 1½ oz. to 2 oz. "seed," whether cut or uncut, is the best; that the bigger the "seed" planted, the smaller the size of ware potatoes in the resultant crop.

To deal with individual classes of potato :—

Earlies.—The respective merits of the older varieties are well known and need no description; those to be recommended can be classified for time of maturity and order of yield as follows :—

Earliest	*Heaviest cropper*
Epicure	Epicure
Duke of York	Duke of York
May Queen	Eclipse
Sharpe's Express	Sharpe's Express
Eclipse	May Queen

These varieties deservedly retain their popularity with the public. In 1928, however, Arran Crest showed itself a serious competitor to Epicure; it proved to be seven days earlier, a somewhat heavier yielder, and as good or better as an early bulker. It is much the same shape as Epicure, but unlike the latter its skin never becomes tinted on exposure. These qualities, combined with the fact that it is immune from Wart Disease, make it well worth a trial where Epicure has hitherto been grown.

Another comparatively recent variety is Di-Vernon, a very distinctive purple mottled kidney type of about the same maturity as Epicure. It is immune from Wart Disease and is very early. Stocks of this variety are often severely affected with Mosaic disease, and it is not recommended unless healthy stocks can be guaranteed, and then for garden rather than for field cropping.

Second Earlies.—Many early maincrop varieties, such as Great Scot, Majestic, and Arran Banner (*see* below), can be grown as second earlies; the only true second early that the Institute's experience allows it to recommend is the old susceptible variety, British Queen.

Early Maincrops.—The more commendable varieties in this group can be classified as follows :—

Earliest	*Heaviest cropper*
Great Scot*	King Edward
King Edward	Majestic*
Majestic*	Great Scot*

As a new introduction, Arran Banner* is worthy of consideration as a substitute for Great Scot, though normally slightly later in maturity. The tubers are white, round, with medium eyes. It is a large cropper and heavy ware producer, and bulks sufficiently early to be grown as a second early. Owing to the large size of the tubers produced, the setts should not be planted more than 14 in. to 16 in. apart. The cooking quality is very fair and improves on keeping.

* Immune from Wart Disease.

Late Maincrops.—The following are the best varieties in this group :—

Earliest	*Heaviest cropper*
Golden Wonder*	Kerr's Pink*
Arran Chief	Arran Chief
Kerr's Pink*	Golden Wonder*

Kerr's Pink is the heaviest cropper so far tested, though only fair in quality. Golden Wonder is an excellent cooking variety, but in general a poor yielder, largely owing to the fact that, until recently, all available stocks were severely infected with virus disease.

* * * * * *

Potato Synonyms

The National Institute of Agricultural Botany has made an examination of the potato sections of a representative selection of the seedsmen's catalogues and lists for 1931. Stocks of potatoes under many of the names which appear in these publications have been grown by the National Institute of Agricultural Botany at the Potato Testing Station at Ormskirk in recent years, and have been adjudged by the Institute's Synonym Committee to be "synonymous" with well-known established varieties. It is gratifying to find that whereas, in 1930, 45 suspected synonyms were represented in these catalogues, no more than 28 have been found in the 1931 issues. It is too early to determine whether, in 1931, the varieties named below are again synonymous with the type varieties set against them, or with some other established variety, or whether they are, in fact, distinct. Prospective purchasers are advised to satisfy themselves by inquiry or guarantee that such varieties are distinct from, or are, indeed, of greater value than, their presumed types. Nor is a so-called "selected" or "improved stock" of an established variety, whether offered for sale under its original or under a new name, to be accepted as an improvement without evidence of adequate trial or sufficient guarantee.

Type variety	*Has had as synonyms in recent catalogues*
ABUNDANCE	Renown.
BISHOP	Advancer.
BRITISH QUEEN.. ..	English Beauty, Royalty.

* Immune from Wart Disease.

Type variety	*Has had as synonyms in recent catalogues*
DUKE OF YORK.. .. (or Midlothian Early)	Cherub, Chester Early, Victory.
ECLIPSE .. .. .. (or Sir John Llewelyn)	Advancer, Colonist.
GREAT SCOT	Dreadnought.
PRESIDENT	Scottish Farmer.
RED KING EDWARD ..	Cleadon Park, Mons Star.
ROYAL KIDNEY ..	Guardian, Queen Mary.
SHARPE'S EXPRESS ..	Earliest of All, Early Favourite, Express.
SHARPE'S VICTOR ..	First Crop.
SNOWDROP	Witch Hill Early.
THE TOWSE	Mein's Chieftain.
UP-TO-DATE	Duchess of Cornwall, Factor, Longkeeper, Prosperity, Scottish Triumph, Sensation, Tremendous.

* * * * * *

Agricultural Students

RETURNS recently received from University departments of agriculture, agricultural colleges and county farm institutes in England and Wales show that, notwithstanding the difficult times through which the farming industry is passing, the numbers of students at these institutions are not only being maintained but in the majority of cases are on the increase. The students at present number nearly 2,200, an increase of about 120 compared with last year and 250 compared with five years ago. This is an encouraging sign of the optimism felt in some quarters for the future of agriculture.

It is true that the returns for one or two of the higher institutions reveal a decline in numbers. The students who would normally have gone to these institutions, however, have not been lost to the industry; the Ministry has been informed that for financial reasons the students have entered less expensive colleges and the satisfactory returns for such colleges bear out this statement. The Faculty of Agriculture and Horticulture at Reading University leads the way with 248 students, an increase of 35 on last year's figure; whilst the South-Eastern Agricultural College, Wye, is continuing the success it has achieved in the past. The number of poultry students at the National Institute of Poultry Husbandry (at Harper Adams Agricultural College) is more than double the number for last year, and this is an indication of the growing importance of the poultry industry in the economic life of the nation, a lesson learned at the World's Poultry Congress in 1930.

In view of the increasing importance attaching to the part played by women in agriculture, it may be mentioned that the numbers of students at the two women's colleges at Studley

(Warwickshire) and Swanley (Kent) are being well maintained. All told, there are 538 women students at these and other agricultural institutions in England and Wales, an increase of 66 compared with last year.

Perhaps the most noteworthy feature of the present returns is the increase in the number of students attracted to the veterinary profession; this is especially interesting when regard is had to the vast national losses inflicted annually by animal diseases, and to the prominence which has recently been given to the future of the Royal Veterinary College at Camden Town. It is noteworthy that this old-established institution is finding it difficult to cope with the number of students entering. The position with regard to the Veterinary Department of Liverpool University is also satisfactory.

An analysis of the returns reveals that, of the 1,600 students attending the higher institutions, 889 are taking agricultural courses, 234 horticulture, 115 dairying, 75 poultry husbandry and 261 veterinary science. All these figures represent increases on those for last year. The duration of the courses taken by these students varies from one to four years.

There are nearly 600 students in attendance at the various county farm institutes throughout the country, where the courses of instruction are shorter and range from a few weeks to a year. Here again there is an increase on the figures for the previous year.

* * * * * *

Young Farmers' Clubs: Annual Conference

THE annual conference of the National Association of Young Farmers' Clubs took place at Montagu House on January 30, 1931. A large attendance of representatives of Young Farmers' Clubs, Local Agricultural Education Authorities and other bodies from all parts of the country met to consider the work of the Association in 1930 and to discuss the programme for 1931.

Professor W. G. S. Adams presided, and at the afternoon session, in the absence, through illness, of Lord de la Warr, Sir Charles J. Howell Thomas, K.C.B., C.M.G., the Permanent Secretary of the Ministry, addressed the meeting. He referred to the part taken by the National Council of Social Service in accepting responsibility for the organization and furtherance of the movement, and to the steady progress which had been made during the past two years. There were now 108 clubs with a total membership of over 2,500 and the journal of the Association, *The Young Farmer*, had advanced its cir-

culation during the past 12 months by nearly 100 per cent., to 2,000 copies monthly. Sir Charles made particular reference to the valuable assistance given to the movement by Local Authorities for Agricultural Education and to the response to an appeal for the help and co-operation of their technical and advisory services. The view of the Ministry was that the development of Young Farmers' Clubs was an important feature of the programme for rural agricultural education, and the Ministry would continue to assist and support the movement as far as lay in its power. The Government grants to the Association for the next three years were to be increased in order to give the organization every opportunity of becoming self-supporting, so far as State funds were concerned, by 1934. The grants proposed were as follows :—

Direct grant	£	*£ for £ grant in respect of funds raised by the Association from voluntary sources.*	£
1931	900	1931	700
1932	600	1932	800
1933	300	1933	900

Subsequent discussions by the Conference related to *The Young Farmer*, club progress and finance, and county co-operation between clubs.

* * * * * *

Soil Sterilization

PROGRESSIVE growers of crops under glass regard soil "sterilization" as a normal part of the year's work; they look on it as an insurance against loss from pests, and as a definite means of increasing soil productivity. It is true that at one time the process was thought an expensive luxury, but experiments made by Sir John Russell and his associates have clearly demonstrated its benefits.

Whatever advantages "sterilization" may claim, there is one question that is of first importance: "Does it pay in practice?" Proof that it does is given in a convincing manner by the increasing number of growers who "sterilize" regularly for this very reason. It must be emphasized, however, that "sterilization" must be thorough; half-hearted inefficient attempts will most likely waste money and give an entirely wrong idea of the possibilities of the process.

As the subject is of great importance to the industry, the Ministry invited Dr. Bewley, of the Cheshunt Experimental and Research Station, to prepare a Bulletin describing the different methods in use and to show their relative values. As a result a new Bulletin* has been issued, in which the author gives a full and clear account of his subject. He avoids highly technical and scientific descriptions, and numerous illustrations assist in explaining the different types of apparatus. Methods of "sterilization" dependent upon steaming, baking, and chemicals are all described and assessed, and useful data relating to costs obtained from practical growers give point to Dr. Bewley's conclusions. The book itself is well produced in clear type on good paper and has an attractive wrapper.

* Bulletin No. 22, *Practical Soil Sterilization*, price 1*s*. 0*d*., post free from the Ministry.

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Production of Home-grown Beet Sugar

ACCORDING to returns made to the Ministry by the beet-sugar factories operating in Great Britain, the total quantity of home-grown beet sugar manufactured during January, 1931, together with the quantity produced during the corresponding month in 1930, was :—

	cwt.
January, 1931	1,380,916
January, 1930	467,760

The total quantities of sugar produced during the two manufacturing campaigns to the end of January were :—

	cwt.
1930–31	8,371,495
1929–30	5,799,529

* * * * * *

"Notes on Feeding Stuffs"

THE monthly notes on feeding stuffs that have been a feature of this JOURNAL for some years past have attracted wide attention, and the Ministry has been indebted successively to the late Professor T. B. Wood, and to Mr. E. T. Halnan, Dr. Woodman and (recently) Dr. Sanders for providing them. The time has now come when Dr. Sanders has expressed the wish to relinquish the preparation of these notes, and as his last article of the series appears in this issue (p. 1261) the Ministry desires to place on record its thanks to him for the care he has devoted to them. In response to an invitation from the Ministry, Mr. W. A. Stewart, M.A., B.Sc., Principal of the Northamptonshire Farm Institute and Director of the Moulton Experimental Farm, has undertaken to contribute the notes on feeding stuffs for the next twelve months.

THE BLIND LOUSE OF THE HONEY-BEE

W. HERROD-HEMPSALL, F.E.S.,
Ministry of Agriculture and Fisheries.

THE Blind Louse (*Braula coeca*) is a tiny, reddish-brown creature, whose habitat is on the body of the honey-bee. It is very prevalent in Europe and South Africa. In this country it makes its appearance in bee colonies spasmodically, *i.e.*, no sign of it may be seen for a number of years ; then, for several seasons in succession, it may be found infesting some colonies of bees in large numbers, but only in specific districts, and even then it is not widespread. It would appear that its activities are confined to the southern and midland counties of England since the writer has never found a specimen north of Nottinghamshire. It is a creature which has intrigued bee-keepers and entomologists in many countries. It was first mentioned in bee literature in 1740, and named by Nitzsch in 1818. In the year 1921, S. H. Skaife* fathomed its life history to a certain degree in South Africa. Previous to his researches, various, and, as we now know, erroneous, statements had been made about its life history.

The earlier theories advanced, apparently without the slightest attempt at verification, appeared to be so obviously correct that they were not questioned, but were quoted by subsequent writers as fact, and, like old women's tales, which lose nothing by repetition, the recorders frequently embellished the description with fantastic ideas of their own.

Boise stated that it is pupiparous and that the pupa is deposited in a cell containing a very young bee larva, where it reaches maturity in about twenty-one days. Packard asserted that almost immediately after the larva hatches from the egg, it sheds its skin and turns to an oval puparium, dark brown in colour. Cowan told us that " the eggs hatch inside the insect, and the larvae are nourished by the secretion from a gland. The pupa is extruded on to the floor-board of the hive ; fourteen days later a perfect insect emerges. The young lice remain on the floor-board until they have the opportunity of climbing on to a passing bee."

Skaife, after describing the finding of tiny eggs on the cappings covering brood of bees, which he suspected were laid by *Braula coeca*, says : " A number of the lice were caught and carefully dissected under a binocular dissecting microscope. In three or four of the females examined, a fully formed

* *Transactions of the Royal Society of South Africa*, Vol. X, Part I, 1921.

egg was found in the ovarian duct, and these eggs were obviously identical with those found on the brood combs. The appearance, size, shape and markings were exactly identical, so that there could be no possible doubt as to their identity. Having thus established the fact that the bee louse is oviparous, and not pupiparous, as is so often stated, an endeavour was next made to trace out its life history."

He then describes how a queenless colony, having laying workers functioning, was discovered, the drones in which were badly infested with *Braula*, and goes on to say ; " A number of the drone larvae were removed from their cells and examined under a lens. In several cases one, and in a few cases two, small dipterous larvae were found lying side by side with the bee larvae. The largest of these dipterous larvae measured 2 mm. in length. The buccopharyngeal armature, the tracheal system and all the sensory papillae of these larvae were exactly similar to those of the embryos found in the eggs of *Braula coeca*, hence there could be no doubt but that these were the larvae of the bee louse."

" Six puparia were brought to light after a prolonged search in the hive mentioned above, and all of these were found in sealed cells containing drone pupae. . . The adults had already emerged from four of the puparia when found, and these adults, pale yellowish white in colour, had made their way to the drone pupa inside the cells. The remaining two puparia were kept in order to watch the emergence of the adults, but unfortunately both died after their removal from the hive. The exit hole in the puparium consists of a rough tear and is apparently made by a ptilinum, for a well-marked ptilinal suture can be seen on the head of the adult."

Prof. A. G. Beliavsky, of Novotcherkassk, Russia,* describes the results of his study of *Braula coeca*, and also gives drawings, copied from Skaife, together with photographs of the incidents. He says : " I found the eggs of *Braula coeca* exclusively on the wax sealings of honey, and only a small number of them in the wax dirt on the floor. The eggs were not distributed on the edges of the cell, but on the capping itself, and were stuck fairly firmly to the capping."

He also states that he found some live larvae of *Braula coeca* in tunnels under the capping, but did not discover anything further.

In 1928, the writer received complaints of damage done to comb honey in sections by some creature tunnelling in the

* *The Bee World*, June, 1929.

cappings. Investigation revealed similar conditions to those experienced in the apiary at Swanley Horticultural College, Kent, in 1899; indeed, the photographs in Fig. D were taken there in that year.

The late F. W. L. Sladen, when residing at Dover, noticed tunnels in the cappings covering honey in sections. Being anxious to discover the creature responsible for the damage, he made appeals to bee-keepers having such sections to send him the cappings. These appeals appeared in the *The British Bee Journal* for August 28, 1902, May 21, 1903 (together with photographs of the tunnels), and June 20, 1912. In the last year he described it as "The Comb Capping Maggot," because at that time he had found the maggot and stated as his opinion that it was "a dipterous larva, possible of the genus *Phora*." His research did not lead to any discovery beyond the maggot.

The writer therefore determined, if possible, to fathom the mystery, and after three years' research has succeeded in so doing. As will be seen from the following particulars, the culprit is *Braula coeca*.

Sladen's statement that he believed it to be a dipterous larva delayed the ultimate result, because for a long time an attempt was made, without success, to find the parents of the larva in the form of a typical, winged fly. This failure led to concentrating on attempts to breed out the larvae to the perfect insects. Methods too numerous to mention here were tried before success crowned the efforts in 1930, when they were bred out from portions of a comb, contained in petrie dishes, kept at hive temperature by placing them over a strong colony of bees. It had been previously discovered that the larvae quickly perish when exposed to a temperature below 98 deg. F.

The first objective was to find out all about the larva and its ways. To this end, portions of capping were cut from affected combs and placed on the alighting-board of a hive containing a strong colony, the inmates of which removed the honey and rendered the capping free from all stickiness in about three minutes, thus exposing the tubes made by the burrowing larvae. The portions of capping were then placed under a dissecting microscope, upside down, and the tunnels opened up with a very fine needle, as seen in the photo-micrograph Fig. A (No. 1). For some time only eggs were discovered, one of which may be seen in the same illustration indicated by an arrow; but eventually all the larval stages intervening

between the egg and the pupa were found as well as the puparium itself.

The skin of the larva, no matter what its age, is very delicate and easily ruptured. Right from its birth to the time when it changes into the pupal stage, the grub is able to travel along its tunnel as rapidly as does the larva of the wax moth in its burrow.

A typical piece of badly infested capping is presented in Fig. A (No. 2), showing, at 1, the egg; at 2, a small larva just emerged from the egg; at 3, a larva just before changing to a pupa; at 4, a puparium immediately it was formed; and at 5, a puparium on the verge of emerging.

NOTE.—In this picture may be seen another incident, unknown until now, and although not connected with *Braula*, it is given as a matter of interest. It was, found that after the bees cleaned the honey from the portions of infested capping as described, innumerable wax scales were left in the shallow cell cavities remaining attached to the capping, thus showing that during the work of secreting wax and storing honey many wax scales fall and enter the cells being filled with honey, from which they are not retrieved.

The egg is laid by the female *Braula* on the inside edge of a cell filled with honey, and fastened by one end only, just previous to sealing over. It is bright white in colour, 0.75 mm. long and 0.45 mm. broad, and has a ragged fringed edge on either side. The photo-micrograph at Fig. B (No. 1) shows two eggs, the one on the right being a three-quarter view of a perfect specimen revealing the ragged fringed edge; that on the left had the outermost cover torn from one side, the inner covering hiding a dried-up embryo. The picture at Fig. B (No. 2) is of the same pair of eggs, but in this case the inner covering was removed from that on the left, thus revealing the dried-up embryo (dark mass).

The photo-micrograph Fig. B (No. 3) is of an egg-shell on the right fastened to an egg on the left containing an embryo, in which the shape of the buccopharyngeal armature shows clearly.

The larva emerges from the attached end of the egg, and evidently lives upon honey and pollen grains. As it progresses along the inner surface of the capping through the air-space which intervenes between it and the honey, it makes a tube or tunnel by breaking the wax of the cell walls into small fragments with the hooks of the buccopharyngeal armature, and converting the pieces thus severed into a mastic, which is impervious to honey, so that the interior of the tunnel remains quite dry. The end of the egg is secured to the wall of

the cell very firmly by a glutinous secretion; therefore, after the larva comes forth, the vacated shell remains so fixed and thus prevents the percolation of honey into the tunnel. Immediately it hatches the larva measures 0.88 mm. long and 0.25 mm. broad; the diameter of the tunnel is 0.30 mm. inside and 0.70 mm. outside, the wall being 0.2 mm. thick. When full grown, the larva measures 4.60 mm. long and 1.30 mm. broad, while the diameter of the tunnel is 1.80 mm. inside, and 2.5 mm. outside, the wall being 0.35 mm. thick. The larva now ceases to perambulate and rests in a *cul-de-sac* of the tunnel, where it changes into a puparium measuring 3.5 mm. long and 1.18 mm. broad.

When examined superficially, the cappings of an infested comb have the appearance of being intersected with fine fractures, but when such a comb is viewed against a strong light the tunnels are broad and quite distinct, similar to the burrow of the leaf miner.

During the early part of the work (*i.e.*, when looking for a fly) it was puzzling to find occasionally on the face of the comb, and following the traverse of the tunnelling, a tiny ridge of granular wax, similar to the earth uplifted by a mole when burrowing, as seen in Fig. A (No. 3), and having an occasional hole as at Fig. A (No. 4). This was at first thought to be the opening through which the creature escaped; later investigations showed that it is merely a means of getting rid of excess material. As a rule, the tube follows the walls of the cells, but, occasionally, tunnels of different sizes may be found in a mass and intersecting each other, as at Fig A (No. 5). In such cases, as seen in the picture, the portion of the cell walls, accommodating the aforementioned air space, is entirely consumed within the affected area.

In the enlarged photo-micrograph of a fully developed larva, Fig. B (No. 4), the perfect buccopharyngeal armature is revealed, whilst the segments are clearly defined, as well as the knob-like sensory palpi at both the anterior and posterior ends, those at the former being the longest. If such a larva be placed on a glass slide under a microscope the observer will be astonished at the rapidity with which it is able to travel. At this stage of development the creature prepares for escape, when fully formed, by making an extremely fine circular cut, similar to the cut made by a diamond on glass, through the wall at the anterior end of its prison, by means of the hooks of the buccopharyngeal armature. This cutting is impossible when the animal reaches

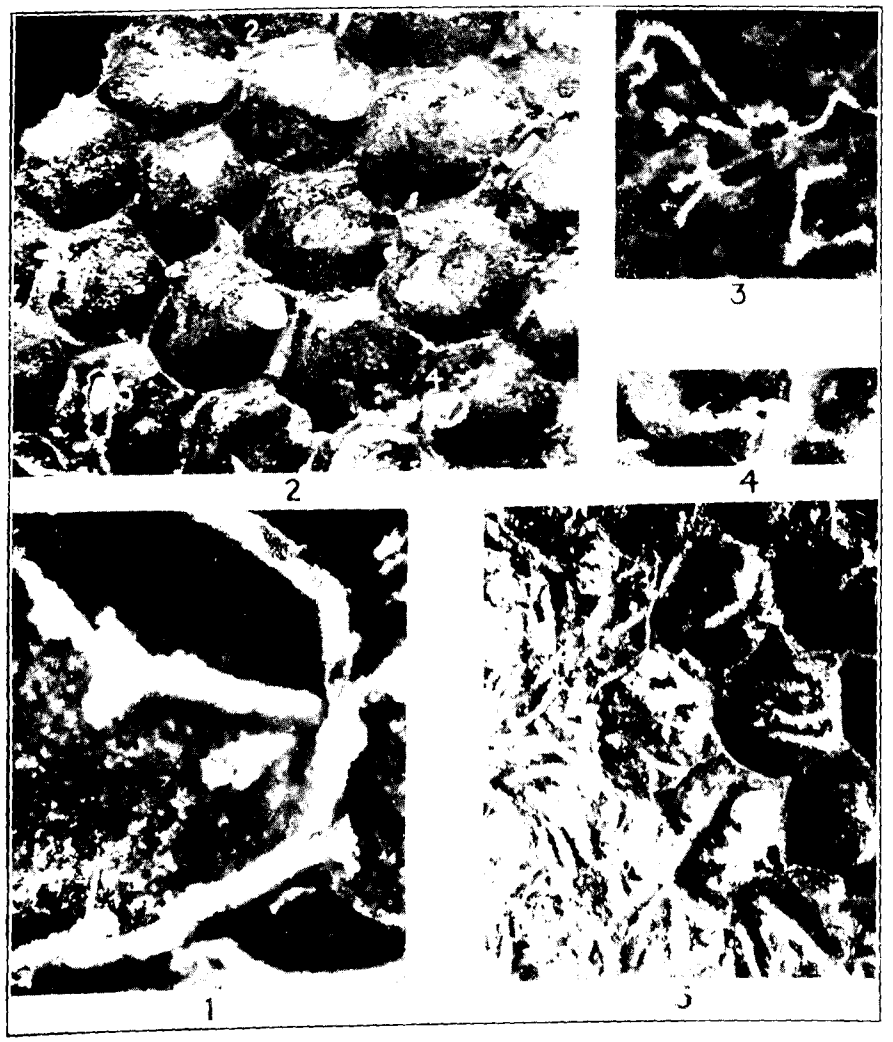


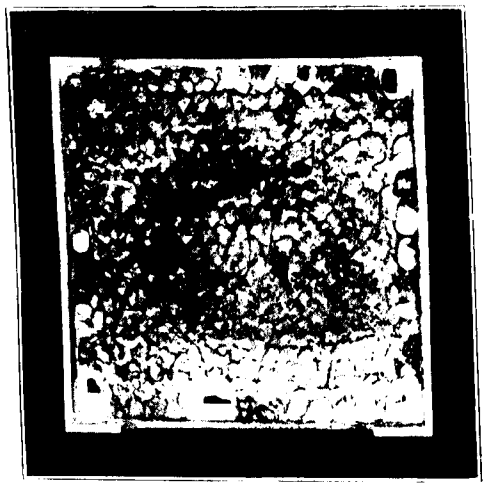
FIG. A.

Copyright: W. Herrod-Hempsall

THE BLIND LOUSE OF THE HONEY BEE.

To face page 1180.

1.



2.

3.

Fig. D. *Copyright: W. Herrod Hempsall*

The Blind Louse of the Honey Bee.

maturity, because then, as will be shown later, it does not possess jaws, but only a round sucking mouth. It is a marvellous feat for the larva to make the above-mentioned clean incision without disturbing the encircled material in the least, when we consider that the substance penetrated is 0.24 to 0.25 mm. thick.

The photo-micrograph Fig. B (No. 5) shows a nymph in the first stage of that phase of its life in its pupal skin. The buccopharyngeal armature, now detached and useless, may be seen lying over the back of the developing head. At Fig. B (No. 6) the nymph was almost ready to emerge from its prison. Here, again, the buccopharyngeal armature, although not so distinct, may be seen lying over the back of the head, whilst the entire dorsal portion of the body, having the legs folded at the sides, is plainly visible through the enveloping pupal skin. The photograph of a puparium lying in position with its head towards the aforementioned lid to be, Fig. C (No. 1), was made possible by breaking away the surrounding wax capping.

In order to see the creature emerge, search must be made by means of a lens, at the end of well-defined tunnels, until a circular cut is discovered, as at Fig. C. (No. 2). Presently, often a very long presently, a slight movement of the encircling material may be seen. The creature inside has then made a tear in the frontal cap of the chrysalis case or puparium by inflating the ptilinus—a small bladder-like organ—which may be seen forced out at the apex of the head in the pressed adult specimen at Fig. B (No. 9). A well-defined ptilinal suture may be found on the head of the adult *Braula*. From now on, as recorded by the camera, the act of emerging is as follows :—At No. 3, in Fig. C, the cap, so as to speak, may be seen slightly raised; at No. 4, the two front feet were projected through the opening, to act as a lever while the creature forced its head upwards against the lid until it reached the position seen at No. 5. It then struggled forward until the second pair of legs were extricated from the cavity as at No. 6, and all three pairs free at No. 7. At No. 8, the point of the abdomen was just emerging from the hole; note the cap, raised like the hinged lid of a box when half open—similar to the manner in which the cap is left on a queen-cell after the princess has emerged. At No. 9, the creature had got a little farther, whilst, at No. 10, it had travelled to the back of the uplifted cap. The body of the adult, exclusive of the hairs and legs, measures 3.0 mm. long and 2.0 mm. broad. When the animal first escapes from its prison it is pearly-white in colour and almost

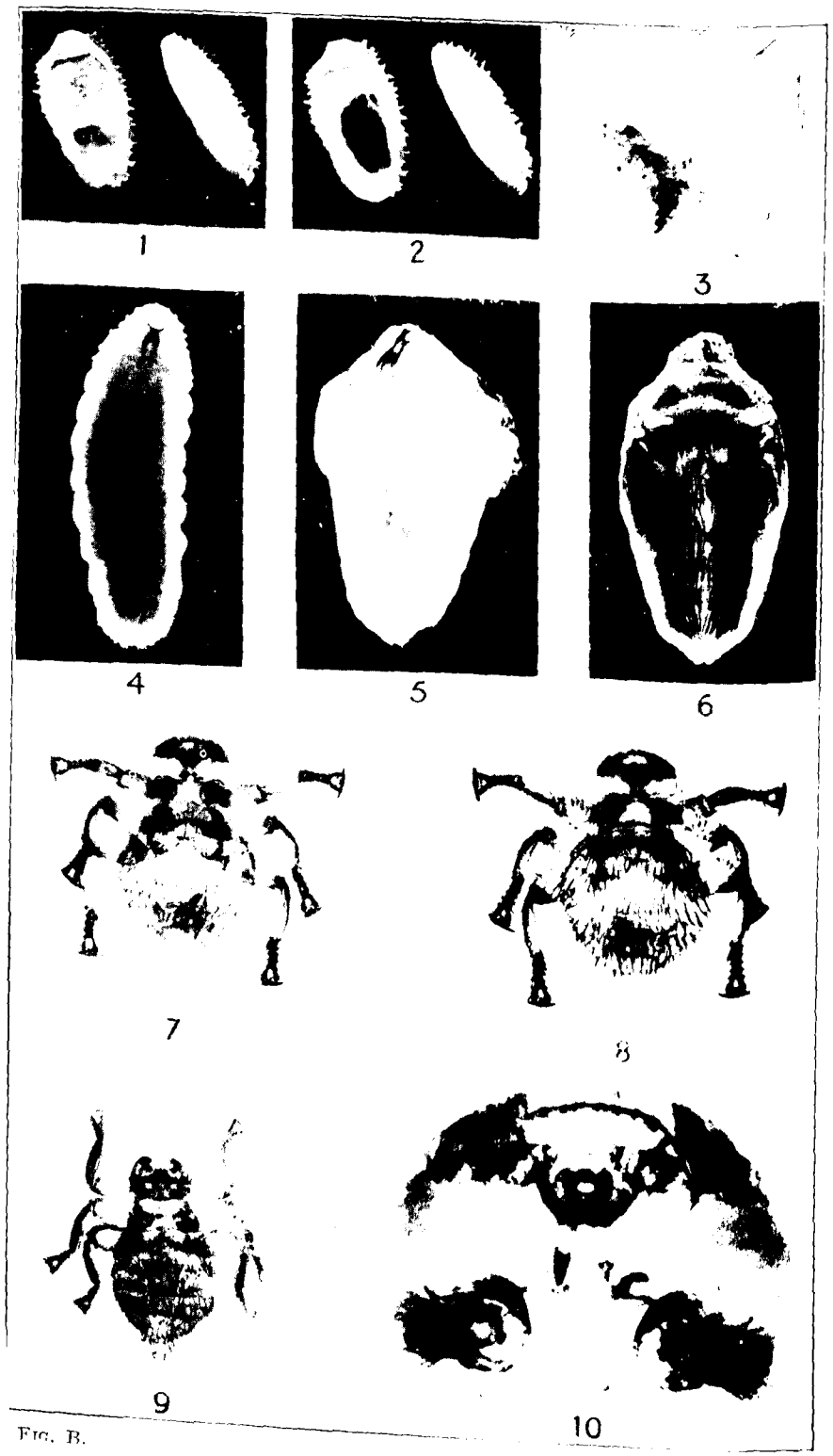


FIG. B.

THE BLIND LOUSE OF THE HONEY BEE.

Copyright: W. Herrod-Hempsall

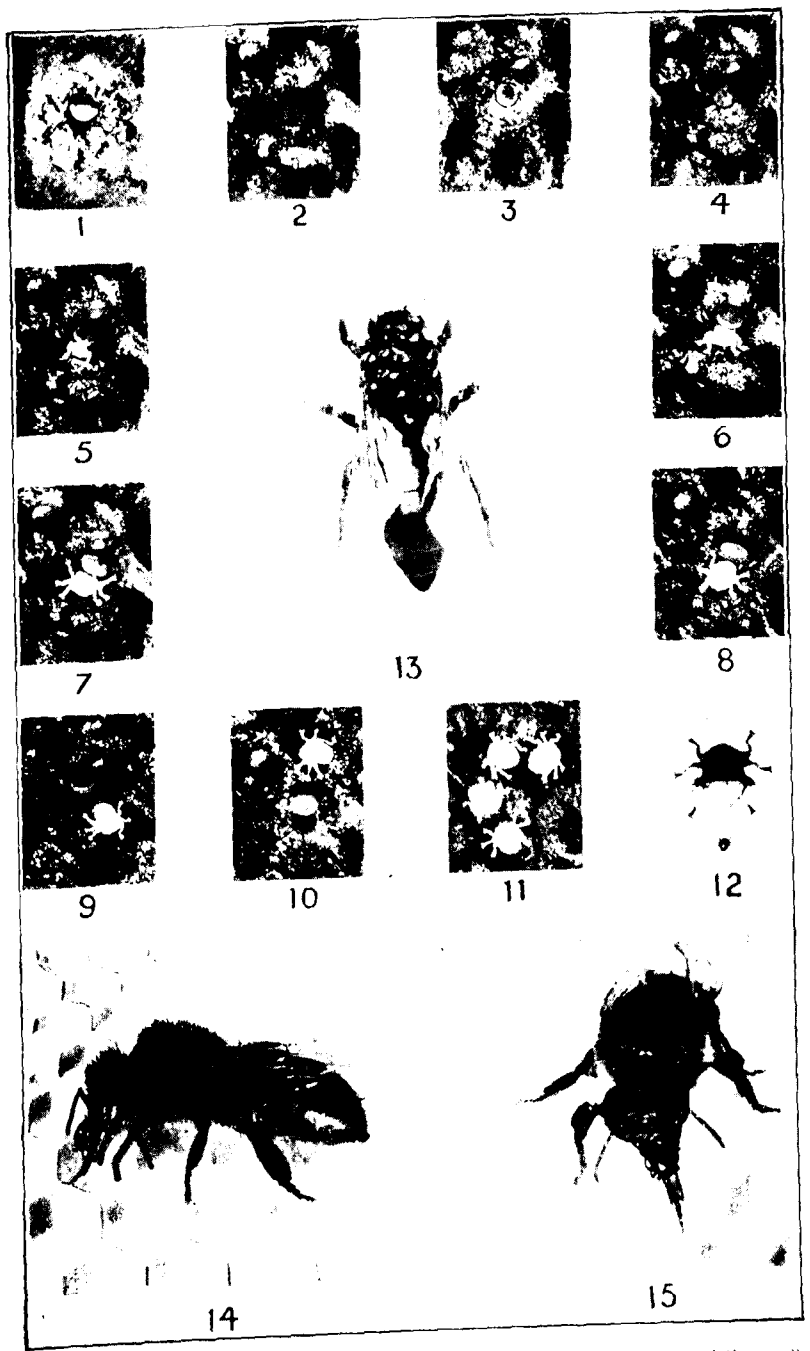


FIG. C.

THE BLIND LOUSE OF THE HONEY BEE.

Copyright: W. Herrod-Hempsall

transparent. A curious feature is that the abdomen contains a large air-bubble; this may be observed as a light spot, through halation, in the photographs Nos. 9, 10 and 11.

The breeding season commences in May and closes towards the latter end of September. The time occupied in growth, from the egg to the perfect insect, is twenty-one days.

It was found that when the *Braulae* emerged from the comb in the petrie dishes, which, of course, did not contain any bees, they displayed a social trait by collecting together on the most elevated position of the comb, as did the four at Fig. C (No. 11). Moreover, whether singly or in groups, they remained motionless for long periods. On a number of occasions, for half an hour at a time, close watching failed to reveal even the slightest tremor of the body.

It would appear that the mature insect cannot live on honey from the cells, because it was found that the duration of life never exceeded six hours after emerging from the comb in the petrie dishes isolated from bees. When bees were introduced, the *Braulae* quickly ran to and climbed on to the body of the host by way of the legs. In such cases the *Braulae* compelled the bees to feed them and so lived on. It was observed that the colour of the body gradually changes from white to the permanent reddish brown. The coloration commences at the head and gradually spreads to the posterior extremity. The extent of the coloration at the end of eight hours is shown by the specimen in Fig. C (No. 12), and is fully completed in twelve hours. The photograph of the insect, actual size, is also shown in this illustration for comparison with the enlargement.

The photo-micrographs at Fig. B (Nos. 7 and 8) are interesting, because this was the first *Braula* ever bred in captivity. The specimen is a male and the genital organ may be seen in the illustration at No. 7, which shows the ventral side, whilst No. 8 gives a dorsal view. The female is shown at No. 9, where also the genital organ may be seen.

Braula coeca infests the body of the worker and the queen, but is rarely found upon the drone. As a rule, not more than two specimens are present on the body of a worker at one and the same time, but the body of the queen in an infested colony frequently assumes the appearance of being covered with barnacles, especially the thorax, as was that shown in Fig. C (No. 13), from which were removed twenty-six *Braulae*; this photograph was taken in 1899. The creature is able to move very quickly, and migrates from one host to another by a

jump so rapid that the passing is almost imperceptible. It travels over the body of the bee when disturbed, but its favourite hiding place on the worker is in the joint between the abdomen and thorax, or round the neck, and when so located it is very difficult to see. Moreover, it is not an easy matter to detach it alive from a host with an instrument, because each foot is furnished with hooks and a powerful sucking pad or pulvillus, as seen in Fig. D (No. 1). In fact, so tenacious is its hold, that, when the body is gripping and pulled with forceps, some of the legs frequently come asunder.

It was supposed at one time that the relation of *Braula coeca* to the honey-bee was parasitic, and that it pierced the flexible joints of the armour and sucked the blood of its host. This, however, is not the case, for, as already indicated, the creature does not possess jaws, but only a round, sucking mouth. This organ is shown in the enlarged photo-micrograph Fig. B (No. 10), as well as the four labial palpi; the insertion of the anterior pair of legs to the body may be observed on either side in the lowest portion of the picture.

Instead of being a parasite, *Braula coeca* is commensal, *i.e.*, it feeds with, and not on, the bee. The method by which the creature obtains its food may be observed by placing infested worker bees in a glass tube about 1¼ in. in diameter, fitted with a floor of partly built comb or comb foundation to give them a foothold. It will be seen that, when needing food, the creature leaves its hiding place in the waist or neck, walks to the face of its host and sits on the jaws; then, either by tickling the upper lip of the bee or by some other means, compels it to extrude its tongue, from which the *Braula* takes its fill of food and then departs whence it came. Immediately a *Braula* reaches the face of a bee intent on food, the latter stands stock still, and does not attempt to walk until its unwelcome companion departs from that position. The incident of feeding is shown by the photographs in Fig. C (No. 14, side view and No. 15, facial view); in No. 15, a second *Braula* may be seen perched on the right foreleg of the bee.

Braula coeca does not find the bee a willing commissariat department, for the host tries to rid herself of the unwelcome guest by scraping it away with her legs, but eventually gives in and supplies the food demanded. The whole business is reminiscent of that seen to take place when ants obtain food from heavily laden bees that fall short of the alighting board, and land upon the concrete slab supporting the hive. Such bees stand still for a while to rest, and whilst

so doing an ant concentrates on an individual bee, and runs round and round her until she extends her tongue and allows her tormentor to feed from it.

Braula coeca is supposed to perish in this country during the winter, and its presence from year to year is attributed to importation on the bees arriving from more sunny climes, such as Italy. That it survives the winter here may be regarded as certain. As evidence that such is the case, experimental colonies examined on January 25, 1931, were found to contain *Braula coeca* still infesting the bees.

Usually the pest has been exonerated from being the cause of any mischief in connexion with apiculture, other than irritating the worker bees, and, through its partiality for the body of the queen, preventing her from carrying out her duty of egg-laying comfortably and efficiently. From the foregoing, it will be realized that the tunnels made by the larvae in the cappings of comb honey give it such an unpleasant appearance as to render it unsaleable. The illustration at Fig. D (No. 2) shows the distasteful appearance of a section of comb honey so damaged, whilst an enlargement of the same tunnels is presented at Fig. D (No. 3). Moreover, apart from the defect described above, the capping is rendered so weak at the sides of the burrows that, when removed from the colony, the honey absorbs atmospheric moisture, becomes thin, and quickly percolates through and trickles over the face of the comb and utterly ruins it.

The writer has found that tobacco smoke is fatal to *Braula coeca* in from one to two minutes. If an infested queen is held in the closedh and, and tobacco smoke is driven in from the mouth, the above assertion will be quickly proved correct, for all the creatures fall away dead or dying. Therefore, the means whereby an infested colony may be freed from the pest is obvious, *i.e.*, by driving tobacco smoke into their home, when the asphyxiated *Braula* falls to the floor-board. To make matters safe, it is just as well to remove the brood chamber and brush the floor-board clean, to remove any which might by chance recover.

The writer desires to tender his thanks to Mrs. C. Barrow Simonds, Miss M. M. Taylor, Messrs. H. P. Young, H. Priddis and A. Parrington for their kindness in supplying affected material for the purpose of this research; and to Mr. J. Page for taking the photo-micrographs shown in Fig. B.

* * * * * *

THE CONTROL OF THE COMMON GREEN CAPSID BUG ON RED CURRANTS

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UNTIL recent years, the capsid most commonly found damaging red and black currants was the Apple Capsid Bug (*Plesiocoris rugicollis*), and this pest still causes damage in some plantations. Latterly, however, the Common Green Capsid Bug (*Lygus pabulinus*)* has been responsible for serious damage to red and black currants, to gooseberries, and to strawberries interplanted with these crops; so that this insect, which is found all over England, is now regarded as one of the more important pests of bush fruits.

In 1929, in some experiments carried out near Wisbech,† a proprietary mineral oil emulsion, used at 7 per cent. concentration, applied on March 6, gave a fairly good control of the Apple Capsid Bug, a rather better control than that obtained by the use of a proprietary "Modified Long Ashton" type wash at a strength of 12 per cent.

The experiments here described were designed, therefore, to test the comparative values of mineral oil emulsions and the "Long Ashton" type wash for the purpose of killing the eggs of *L. pabulinus*. Two plantations at Cottenham, Cambs., about a quarter of a mile apart and belonging to different growers, were chosen for the experiments.

Experiment A.—The plantation consisted of three rows of old bushes of Fay's Prolific red currant which had received very little pruning and were, consequently, rather thick. The bushes were in the middle of an orchard, with mixed plums and apples on either side. The washes were applied on February 26, 1930, by means of a barrow-type, hand-power machine, the nozzle being adjusted to give a moderately coarse spray. *Soft water* was used for mixing the washes. The bushes were dry, the weather mild and the wind slight. About half-a-gallon of wash was used per bush, but less of the "Long Ashton" wash was required to cover a bush than of the mineral oil emulsions, the former being much easier to see on the bushes.

Each plot consisted of about twenty bushes and the application of the washes, and their strengths, were as follows:—

Plot 1: Mineral Oil Emulsion A, 7½ per cent.
Plot 2: Control.

* The life history of *L. pabulinus*, and the damage caused by it, are described by Petherbridge and Thorpe, see *Ann. App. Biol.*, Vol. XV, No. 13, 1928.

† By F. R. Petherbridge and W. G. Kent, see this JOURNAL, February, 1931, p. 1078.

Plot 3 : Mineral Oil Emulsion B, 7½ per cent.
Plot 4 : Control.
Plot 5 : "Long Ashton" wash, 10 per cent.
Plot 6 : Control.
Plot 7 : Mineral Oil Emulsion B, 7½ per cent.
Plot 8 : Mineral Oil Emulsion A, 7½ per cent.
Plot 9 : Control.
Plot 10 : "Long Ashton" wash, 10 per cent.

When the buds had opened in April, it was noticed that the "Long Ashton" wash had injured a few of the buds and had retarded the opening of the others. In June, there were obvious differences in the amount of capsid markings on the various plots. The whole of the capsid damage on these bushes was due to *L. pabulinus*, as *P. rugicollis* was not found.

Results.—On July 8, the number of marked shoots, and the total number of shoots on the bushes of two of the three rows, were counted, and in this way the percentage of marked shoots on each plot was obtained. It is noteworthy that there was practically no migration from one plot to another, probably on account of the abundance of weed hosts. The results obtained are shown in Table I.

TABLE I.—EXPERIMENT A : COTTENHAM, CAMBS, 1930

Plot	*Treatment sprayed on February 26*	*Percentage of marked shoots*
2, 4, 6, 9	Control	72·6, 59·3, 60·7, 68·4
5, 10	"Long Ashton" wash, 10 per cent.	48·5, 58·8
1, 8	Mineral Oil Emulsion A, 7½ per cent.	27·7, 11·2
3, 7	Mineral Oil Emulsion B, 7½ per cent.	10·1, 8·1 (= 8·0)

Experiment B.—The plantation consisted of 24 rows, each with about 15 bushes of young red currants (variety unknown) interplanted with young bush apple trees. The washes were applied on February 26 as in Experiment A, but, in this case, hard water from a well at the edge of the plantation was used. About 6 gal. of wash was used for each row of 15 bushes.

There was a certain amount of oil separation from the "Long Ashton" wash. No damage to the bushes was noticed.

Each plot consisted of two rows and each treatment was applied to two plots. The sprayed plots were separated by unsprayed plots. *P. rugicollis* was not found on these bushes.

The results obtained are shown in Table II:—

TABLE II.—EXPERIMENT B : COTTENHAM, CAMBS, 1930

Plot	*Treatment sprayed on February 26*	*Percentage of shoots marked*
4, 10	Control	57·4, 55·4
1, 7	"Long Ashton" wash, 10 per cent.	48·9, 57·5
3, 9	Mineral Oil Emulsion A, 7½ per cent.	7·9, 23·1
5, 11	Mineral Oil Emulsion B, 7½ per cent.	2·4, 3·8

From the above results, it will be seen that one mineral oil emulsion gave a good commercial control of *L. pabulinus*, whereas another mineral oil emulsion has only given a moderate control.

"Long Ashton" wash, at a strength of 10 per cent., gave very little control of *L. pabulinus* in the above experiments, and in one of them killed a few of the buds.

In experiments, carried out by Staniland and Walton on Black Currants,* "Long Ashton" wash at a strength of 10 per cent., applied February 5, 1930, reduced the damage due to *L. pabulinus* and *P. rugicollis* from 30 per cent. to 10 per cent., whereas with a new wash, consisting of an emulsion of equal parts of a high-boiling neutral tar oil and a heavy paraffin, applied at the same time, they obtained almost a complete control of these bugs without causing any injury to the bushes.

Injuries to Fruit Bushes caused by Winter Spraying.—In some experiments carried out at Bluntisham, in collaboration with Mr. F. Tunnington, serious damage was caused to gooseberries, and some damage to red currants, by winter spraying with the above washes. The spraying was done on January 24, 1930, by means of a barrow-type machine and a fairly coarse nozzle.

The mineral oil emulsion A caused no damage when applied alone at 7½ per cent., but when a mixture of 7½ per cent. mineral oil emulsion A with 7½ per cent. "Long Ashton" wash was used, the whole of the fruit buds on the gooseberry bushes were killed. Later on, adventitious buds formed, which, on opening, developed small abnormal leaves, and the bushes appeared to be damaged apart from the loss of crop.

* See this JOURNAL, August, 1930, p. 475.

With red currants the damage from this mixture was not nearly so severe and was very variable. Some of the bushes suffered very little, on others some of the fruit buds were killed, and, on a few, occasional branches were also killed.

The "Long Ashton" wash applied at 10 per cent. killed a number of the gooseberry fruit buds and also a few of the red currant fruit buds. When applied at 12½ per cent., the damage was rather worse, but not as bad as that caused by the mixed wash.

This possibility of the damage to bush fruit (and also to strawberries) must be borne in mind when planning the spraying for top trees which are underplanted.

* * * * * *

THE ESTABLISHMENT OF GRASSES ON VERY ACID MOORLAND

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ONE of the many problems confronting agriculturists, at the present time, is the conversion of poor grade pastures into better grazing land, with a consequent increase in stock-carrying capacity.

The work of Professor Stapledon and his staff at the Welsh Plant Breeding Station has clearly shown that this can be accomplished by correct manuring and judicious grazing. On very acid moorland soils, however, the problem is not one of conversion so much as renovation. The problem therefore resolves itself into the compounding of a seeds mixture which will result in a good "take" with the minimum expenditure on fertilizers previous to sowing.

The writers, although not directly associated with agricultural practice, were confronted with this difficulty when asked to prescribe a suitable fairway seeds mixture for a golf course which was to be constructed on a typical moorland soil near Bingley. The elevation of the area in question is 900 feet, and the rainfall on the estate, over the past 30 years, averages 36 in. —extremes, 46 in. and 25 in.

The soil was of an acid and peaty nature, overlying Millstone Grit, the dominant vegetation being heather. To obtain some information on the germinating capacity of various grasses under such extremely acid conditions, the experiment here noted was laid down, and the results obtained were so striking

that they are considered worthy of putting on record for the use of those concerned with renovating soils of this kind.

An area of 90 sq. yd. was marked off for the purpose of the investigation, and subsequently divided into 18 plots of 5 sq. yd. each. The plots were arranged in three traverses as shown in the diagram below :—

Plots	1	2	3	4	5	6
Traverse A	.....	.....	.....	.....	.....	.....
Traverse B	.....	.....	.....	.....	.....	.....
Traverse C						

Traverse A did not receive lime ; traverse B received ½ lb. ground carbonate of lime per sq. yd. (*i.e.*, rather more than 1 ton per acre) ; and traverse C had 4 lb. per sq. yd., equivalent to just over 8½ tons per acre.

The lime was applied on September 12, 1929, four days before sowing the seed. The following grasses (mostly acidophiles) or mixtures were used :—

Plot 1
Wavy Hair Grass (*Aira* [*Deschampsia*] *flexuosa*)

Plot 2
Poa pratensis

Plot 3
South German Mixed Bent (*Agrostis* spp.)

Plot 4
Hard Fescue (3 parts)
South German Mixed Bent (1 part)

Plot 5
Hard Fescue

Plot 6
Sheeps Fescue
Clover (Wild White)
Yarrow
Plantain (*P. lanceolata*)
Poa annua
Timothy

The mixture sown on Plot 4 will probably appear strange to the agriculturist, but it must be remembered that the Research Station at Bingley is concerned primarily with only one aspect of grassland husbandry, namely, turf culture. The question of weed control and infestation on acid soils is one of considerable interest, and the mixture sown on Plot 6 was intended to throw light on the effect of high soil-acidity on germination of certain weeds and meadow grasses.

All the plots were sown at the rate of 2 oz. per sq. yd. with the exception of Plot I, which was sown at double this rate on account of the very low percentage germination of the commercial *Aira flexuosa* seed. Again, this rate of sowing will probably appear heavy to the agriculturist, but it must be

remembered that this is the usual rate of seeding for putting greens, and is about twice the full economic rate for fairways.

All the plots were first examined on October 1, following rain on September 29, 1929, and notes taken on the amount of germination on each plot.

On the three *Aira flexuosa* plots there was slight germination, the unlimed plot showing up best. In all other cases, germination was very poor on the unlimed traverse, but where both heavy and light applications of lime had been given there was satisfactory germination. On this date the clover had not germinated on the unlimed part of Plot 6, but was starting well on the limed sections. At this time as judged by Universal Soil Indicator the pH* of traverse A was 4·0, of B 7·0, and of C 8·0, this being on the top 2–3 inches. Below this depth no effect of lime was detected.

A second examination of the plots was made ten days later (*i.e.*, one month from sowing). On traverse A (not limed) germination of *Poa pratensis* and German bent was bad and hard fescue fair. *Aira flexuosa* was still backward, though slightly better here than on the limed traverses. A few clover seedlings were found on Plot 6, but no plantain or yarrow.

On both traverses B and C, which received lime, germination was vastly different from traverse A. In all cases except *Aira*, the effect of lime was very obvious in bringing about better germination, but it was noticed that heavy liming gave a germination only slightly better than light lime. Plantain and yarrow came up on the limed plots and there was evidence in the case of *Aira flexuosa* that actually lime had a slight depressing influence on the germination.

In the next few months any seedlings produced on the unlimed traverse withered and died with the exception of the *Aira flexuosa*.

After twelve months the differences between limed and unlimed parts was remarkable and the photographs (Figs. 1 and 2) taken on October 7, 1930, serve to illustrate this, and they show very strikingly that *Aira flexuosa* was the only grass able to germinate and persist without the previous application of lime. There are indications also that this grass flourishes better in unlimed soil than limed. The unlimed plot, sown with *Aira flexuosa*, produced a good turf, but all other unlimed plots were complete failures.

* A scale for measuring acidity. The neutral figure is 7·2. Lower figures (from neutral downwards) indicate progressive degrees of acidity; higher figures (from neutral upwards) indicate progressive degrees of alkalinity.

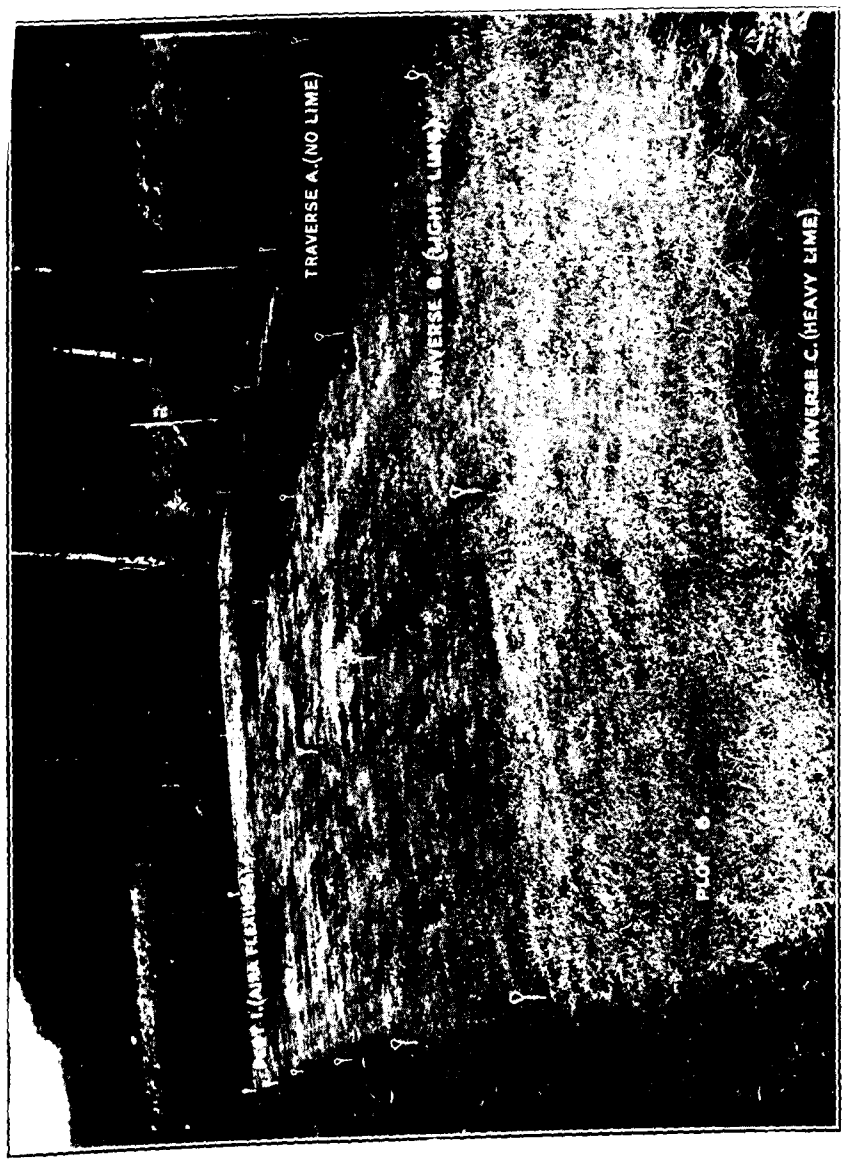

FIG. 1.—Traverse A. (no lime). Note failure of all plots except Plot 1 (*Aira flexuosa*). Plot 1 (background) sown with *Aira flexuosa*. Plot 6 (foreground) sown with *Poa annua*, Timothy, Fescue, etc. Note equality of Traverses B. and C. (light and heavy lime).

Fig. 2. Traverse A. Note failure of all plots except *Poa flexuosa* in foreground, which is established as well as the others on the fined parts. Note similarity of Traverses A and C. Small light objects in foreground are leaves.

THE ESTABLISHMENT OF GRASSES ON VERY ACID MOORLAND.

The investigation also indicated, in spite of a slightly poorer germination on the light-limed traverse, as against the heavy, that after a lapse of twelve months, or even less, no distinction could be made between the swards. It remains to be seen whether this apparent equality will be preserved over a number of seasons, or whether supplementary dressings of lime will be necessary.

The pH of each traverse, sampled to a depth of 3 in., was colorimetrically tested after twelve months (at the time the photographs were taken) with results as follows :—

Traverse A = 4·3 B = 4·5 C = 7·8

It should be explained that the whole experiment was duplicated on a slightly less acid woodland soil with substantially similar results.

The tentative conclusion may be drawn from these preliminary investigations that grasses, which will not establish themselves in this acid moorland soil, only require sufficient lime to help them over the germination period. Whether this is due to the temporary reduction of the acidity, or to the release of nutrient materials available to the seedlings, remains to be demonstrated by further experiments.

The lime requirement of this moorland soil, as determined by the Hutchinson McLennan method, is seven tons of ground carbonate of lime per acre, which is much in excess of the amount found necessary in these experiments to obtain satisfactory establishments.

In view of the tremendous expense incurred in liming highly acid soils at the present day, it would seem that additional experiments to investigate the minimum amount of lime or fertilizer (*e.g.*, clay) necessary to produce a "take" might prove fruitful. With this object in view, further experiments are to be conducted, not only with the above grasses but also with species more commonly employed in agricultural practice.

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WEEDS OF GRASS LAND—IV*

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Dyer's Green-Weed (*Genista tinctoria* L.) is a perennial plant 1 to 2 ft. in height, branched and shrubby, with smooth spineless branches, entire ovate-lanceolate leaves ½ to 1 in. long, and, for the size of the plant, rather large yellow flowers, somewhat like those of broom or gorse, in long racemes. The flowers appear in July to December (Fig. 1).

This plant was formerly used as a yellow dye, and it is possible that it was the *planta genista* that formed the badge of the Plantagenets.

This weed is in some districts a serious trouble in grass land, especially on clay pastures. Stock do not usually appear to touch it, but it has been observed that "cows will sometimes eat this plant, and it communicates an unpleasant bitterness to their milk, and even to the butter and cheese made from it."† Knapp‡ states that dyer's greenweed "is seldom eaten by cattle except in cases of great necessity, and remains untouched if other food be obtainable."

This species should be cut regularly to prevent seeding, or it may spread very rapidly. Cutting, in association with sound manuring—including a dressing of 6 to 10 cwt. of basic slag per acre—and judicious grazing may be expected to check it.

Rest Harrow or Wild Liquorice (*Ononis spinosa* L.) is a viscid, hairy perennial, with erect shrubby stems 1 to 2 ft. high, narrow, oblong toothed leaflets, and handsome rosy-pink, vetch-like flowers, appearing singly in the axil of the leaves or in leafy racemes (Fig. 2). The plant is generally spinous, and among hay, old dry plants have been mistaken for seedling gooseberries. Another species, *O. repens* L., possesses runners, is usually spineless, and has a strong, disagreeable scent.

Rest Harrow is in some localities a very harmful pest in pastures on poor heavy land, and some forms of it also on dry, sandy, and gravelly soils. It may occur in quantity, and is regarded as an indicator of poor soils.

If this weed is plentiful it must be attacked by thorough and and regular cutting, liming, complete manuring, and close

* The earlier articles appeared in December, 1930 (p. 871), January, 1931 (p. 985) and February, 1931 (p. 1107).

† Johnson and Sowerby, *Useful Plants of Great Britain*, p. 69.

‡ *Journal of a Naturalist*, 1829, p. 76.

depasturing with stock. In bad cases it may be necessary to plough up the pasture, give a thorough cleaning and manuring, and again lay down to grass.

The Beaked Parsleys or Chervils (*Anthriscus vulgaris* Pers. and *A. sylvestris* Hoffm.) are common weeds on practically all soils, on hedge banks, by roadsides, and encroaching on grass land from hedgerows and waste land. The former species (Fig. 3) is an annual, 2 to 3 ft. high, branched and leafy, with tripinnate leaves; the minute white flowers appear in May to June, in umbels which grow from the side of the stem, on rather short stalks opposite the leaves. The small fruits bear hooked bristles.

Wild Chervil (*A. sylvestris*), on the other hand, is a perennial, flowering from April to June. The umbels of white flowers are terminal (Fig. 4) and the fruits smooth.

Where these two plants are plentiful they should be cut regularly before seeding takes place, a plan which soon materially reduces them, for both are spread by seed. It has been stated that the growth of *A. sylvestris* is greatly promoted by nitrate of soda, and the use of this manure should therefore be limited where the plant occurs. Mineral fertilizers, however, especially in conjunction with sulphate of ammonia, promote the growth of clover and grasses, which help to choke out the weed; superphosphate and kainit may be applied at the rate of 2 to 3 cwt. each per acre. If the weeds occur in meadows, the grass should be cut for hay as early as possible. In pastures the mowing machine may be used when necessary to cut patches that may appear.

Cow Parsnip, Hogweed (*Heracleum sphondylium* L.), is a common and well-known perennial weed, which frequently attains a large size (3 to 6 ft. in height). It is a rough, hairy, stout plant, with hollow stems and large leaves (1 to 3 ft.), much less lobed and divided than most plants of the order. The leaves have large pale sheathing bases. The flowers, which appear in July, are white or pink, the outer ones of the umbel irregular, one or more petals being considerably enlarged. Hogweed is not poisonous, like hemlock, and cattle eat it with impunity; tame rabbits are regularly fed on it. It is common on hedge banks, roadsides, waste places, and may encroach on pastures. Where it occurs it may be reduced by regular cutting, the mowing machine being used if the weed extends to large areas. At the same time, the need for liming, manuring and thorough grazing is indicated if the weed is plentiful.

Knapweed (*Centaurea nigra* L.), known under a variety of names, as Hardheads, Hardhack, Black-head, is a perennial plant, with a slender, grooved, usually branched and upright stem, with scattered variable hairy leaves, the upper ones narrow and tapering. The small purple flowers appear from June to October, grouped together in dense globose heads of about 1 in. in diameter, hard and black or dark brown. The heads are not prickly, but roughish.

Knapweed is too common in pastures and meadows, and is occasionally present on lawns, occurring especially on clays, loams, and calcareous soils, particularly if in poor condition. It is chiefly harmful on account of the fact that it is a useless plant, with tough, hard stems that are avoided by stock, although the young leaves are readily eaten by cattle and sheep. If allowed to seed it may spread rapidly and becomes very troublesome, rendering pastures unsightly, and usurping space that should be occupied by better herbage.

On small areas knapweed may sometimes be readily pulled up by hand during wet weather, but as the root system is large and the plant perennial, pieces are often left in the soil to grow again. On large areas the best method of dealing with the weed is to cut it early to prevent seeding, manure the land to encourage better vegetation, and ensure sound grazing.

In the first year complete artificials should be given, further applications following as may be required. If farmyard manure is available, a dressing might be given in the second season instead of artificials. On heavy land basic slag should be employed rather than superphosphate. If such treatment is persisted in, grasses and clovers are likely to become improved and vigorous, when the knapweed will be choked out.

The Ox-Eye Daisy (*Chrysanthemum leucanthemum* L.), sometimes called "Dog Daisy," is an erect perennial with branched stems bearing large white daisy-like flowers, 1 to 2 in. across; the flowers open from June to August. Like knapweed, it is most common in grass land in poor condition, especially on clays and calcareous loams. The general treatment recommended against knapweed is applicable in the case of the ox-eye daisy; and improvement in the condition of the land has the effect of greatly diminishing it. It is significant that in Canada the ox-eye daisy is called "poverty weed." The use of salt has been recommended in the United States. As the seeds of this weed may be found in grass seeds, it is necessary again to advise the use of only pure seeds.

The Dandelion (*Taraxacum officinale* Wigg. or *Leontodon taraxacum* L.) is one of the commonest weeds of grass land and needs little description. If a dandelion plant be examined it will be observed that the dense mass of leaves lies almost flat on the ground, covers comparatively a large area, and tends to smother out good grasses and clovers. The dandelion does more harm in this way than is commonly believed, and is sometimes present in immense quantity (Fig. 5).

Flowering takes place from early spring until the autumn, *i.e.*, from March to October, and if the flowers are allowed to come to maturity large numbers of seeds are produced and distributed by the wind by means of the pappus attachment. The writer has a record of a plant bearing twenty-seven flowering heads, one of which bore 200 seeds, indicating a total of 5,400 seeds on a single plant.

The dandelion possess very deep-seated roots, and as it is a perennial, and the leaves also lie very close to the ground, it is very difficult to eradicate, since it is usually proof against both mowing and spudding—and, indeed, it is often far too plentiful to make spudding a practicable proposition. In general, the most useful means of reducing dandelions is to apply a complete manurial dressing to encourage a better type of herbage; this does much to suppress the weed. Sulphate of ammonia is believed to be particularly helpful against the dandelion. (A pinch of sulphate of ammonia placed on the cut surface of each plant after spudding will kill the roots, but this is too tedious and expensive a process, except in the case of small areas, especially lawns.) Experiments conducted by Dr. A. B. Frank some thirty years ago showed that when dandelions were sprayed when full grown on June 20 with a 15 per cent. solution of sulphate of iron (60 lb. in 40 gallons of water) they became quite black and were killed. As grasses are but little damaged by such a solution, this method might be tried where dandelions are specially plentiful. Experiments conducted at about the same period in both the United States and Germany also showed that a 5 per cent. solution of copper sulphate, applied as a spray at a rate of 160 gallons per acre, largely destroyed the leaves and flowering stems of dandelions, preventing them from seeding. Photographs of the College lawns at North Dakota Agricultural College taken before and after spraying with copper sulphate in 1907 showed the effects very clearly. If such a method is to be tried, a small plot should be treated first as an experiment, to test the effect under local conditions.

The Common Rushes (*Juncus effusus* L., *J. inflexus* L., *J. conglomeratus* L., and various other species) are very plentiful in water meadows, damp meadows by streams and rivers, and similar situations. They are in general perennial plants, with an extensive and deep-seated creeping rootstock, erect, simple, pointed stems containing pith, and leaves that may be slender and flat, or round, resembling the stem. The flowers are brownish or green, somewhat star-like, and in axillary or terminal cymes or clusters (Fig. 6).

Rushes generally occur in damp, sour soils, and even when the surface appears fairly dry their presence usually indicates a wet subsoil, possibly some feet down. The most rapidly effective plan for getting rid of rushes is to ensure that the drainage is good, and that acidity is countered, but frequent close mowing is likely to prove helpful in reducing them considerably. Draining and liming in conjunction with manuring and mowing before seeding will destroy them. It is probable that a dressing of phosphate and finely ground kainit would have a very valuable effect in improving the herbage and reducing the rushes. It is well to run the mower over the patches again before winter, and mechanical treatment with heavy harrows may be useful.

As with cotton grasses and certain sedges, drainage is of prime importance, but the cost of the work is the great stumbling block. If drainage is slow or inadequate, as on many heavy soils, water tends to accumulate in the furrows and encourages rushes and water-loving plants. Improvement by combined liming, manuring, and grazing leads to a more open texture, an increase in clovers, readier drainage and aeration, better utilization of the moisture by the herbage on the ridges, a quicker absorption of the water, and closer grazing. The result is a real and lasting general improvement of the pasture, with greater stock-carrying capacity. This has been demonstrated at Cockle Park, and has been found true by practical farmers. Indeed, at this centre a dressing of basic slag only has resulted in such a change in the turf—previously impervious to rainfall—that it has become open and absorbent, is consequently better grown, more thoroughly grazed, and the rushes have largely disappeared.

Wood Rushes (*Luzula* spp.).—A number of species of *Luzula* are spoken of generally as Wood Rushes on account of their frequent occurrence in thickets, woods, and shady places. Some of them, however, are found on poor open pastures and heaths. One of the latter type is *Luzula campestris* Willd., a

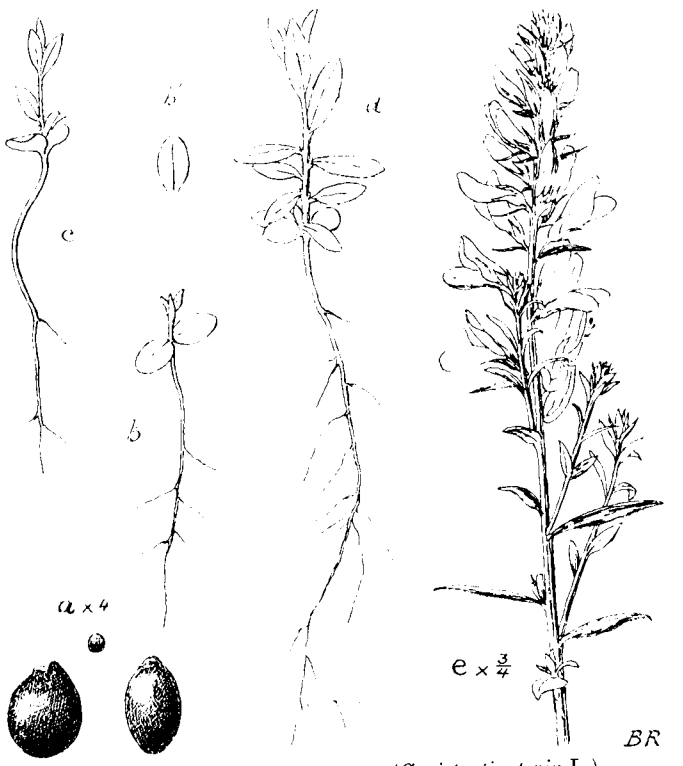

FIG. 1.—DYER'S GREENWEED (*Genista tinctoria* L.).

a, Seeds, natural size and × 4; *b*, early stage of seedling × 1; *b*', surface view of cotyledon; *c* and *d*, second and third stages of seedling × 1; *e*, flowering portion × 3/4.

WEEDS OF GRASS LAND. IV.

To face page 1196.

FIG. 4. WILD CHERVIL (*Anthriscus sylvestris* Hoffm.).

a, Fruit, natural size and by 3; *b*, *c* and *d*, first, second and third stages of seedling; *e*, flowering portion × $\frac{2}{3}$; *e*¹, flower enlarged.

FIG. 3. COMMON SEDGE (*Carex goodenowii* Gay).

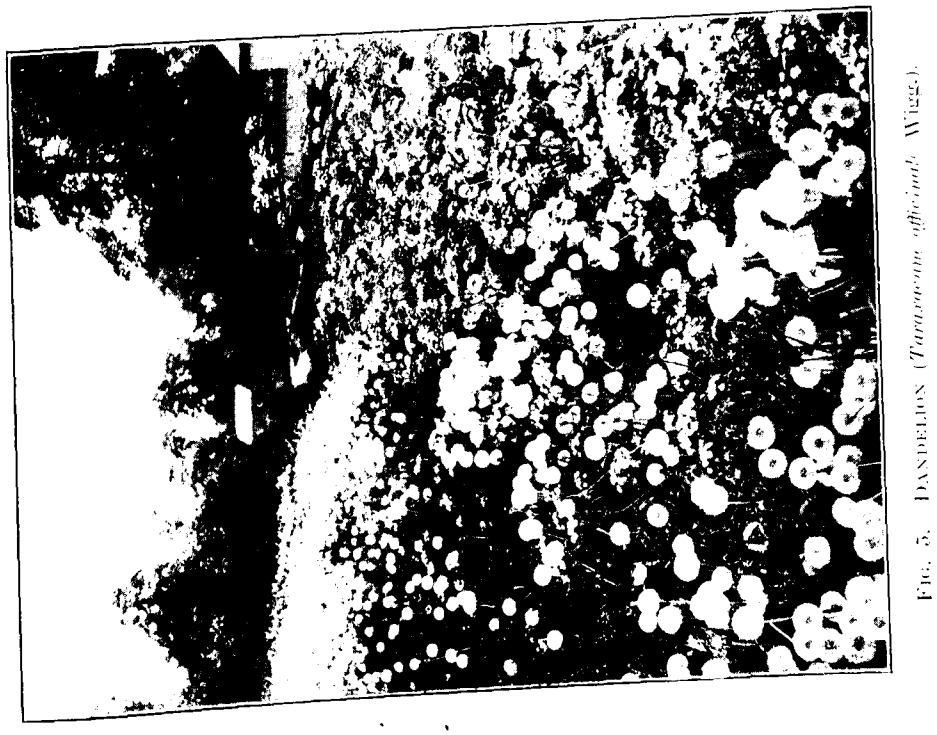

FIG. 5. DANDELION (*Taraxacum officinale* Wigg.).

Showing a field with an immense quantity of seeding heads of this weed.

FIG. 2.—REST HARROW (*Ononis spinosa* L.).

a, Seeds, natural size and × 5; *b*, *c* and *d*, first, second and third stages of seedling × 1; *e*, flowering portion × ¾; *f*, leaflet.

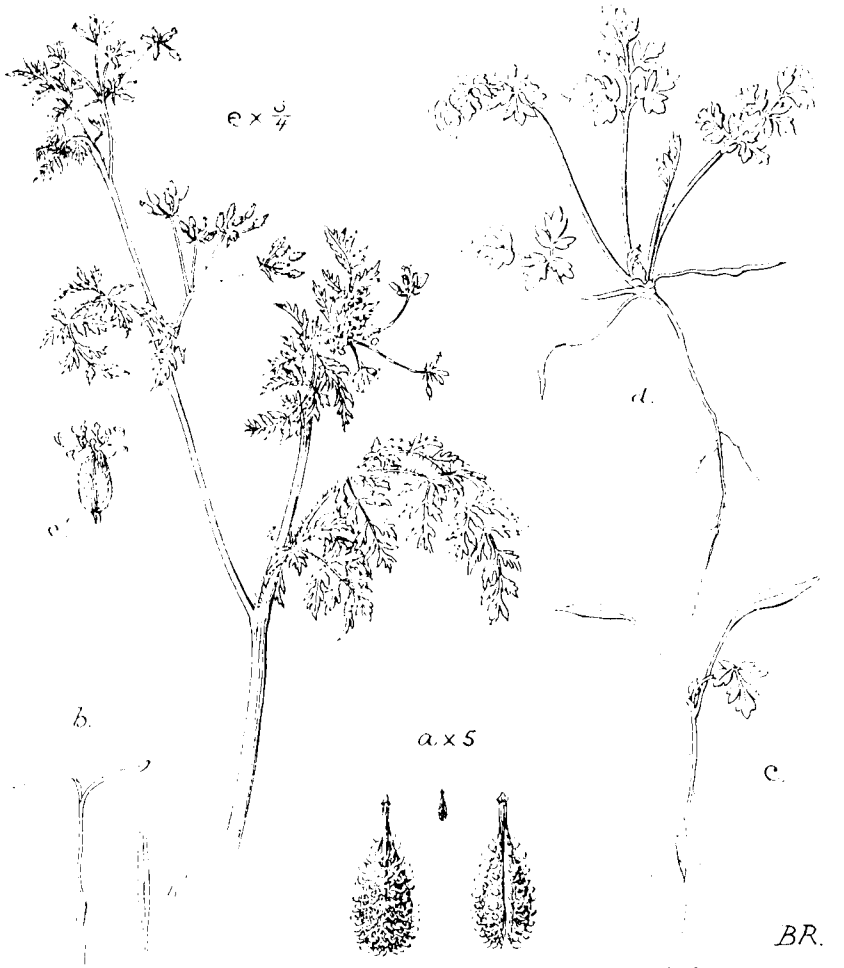

FIG. 3. COMMON BEAKED PARSLEY (*Anthriscus vulgaris* Pers.)

a, "Seeds," natural size and × 5; *b*, first stage of seedling × 1; *b*¹, surface view of cotyledon; *c* and *d*, second and third stages of seedling × 1; *e*, flowering portion × ¾; *e*¹, flower enlarged.

FIG. 6. COMMON RUSH (*Juncus effusus* L.).

FIG. 7. FIELD WOODRUSH (*Luzula campestris* Willd.).

FIG. 8.—COMMON COTTON GRASS (*Eriophorum angustifolium* Roth.).

small grass-like plant (Fig. 7), which is common on dry meadows and pastures on almost all soils. (A tall sub-species of this plant, *L. multiflora* Lej., is common on wet pastures.) It is a perennial spread by means of both seeds and a creeping rootstock; it attains from 4 to 12 in. in height, and has flat, hairy, grass-like leaves—the long whitish hairs being very prominent—and dense clusters of small pale or dark star-like flowers.

Where these weeds are very plentiful, a general improvement in the herbage by liming, manuring, and grazing, and by drainage in the case of *L. multiflora*, is necessary to check them, as it commonly will.

Common Cotton Grass (*Eriophorum angustifolium* Roth.) and **Hare's-Tail Cotton Grass** (*E. vaginatum* L.) are perennial plants common in water meadows (as well as on moors and bogs), and are sometimes troublesome. The former species is about a foot high, and has solitary solid stems and terminal clusters of flowers, the inner clusters being sessile and the outer on slender stalks. The flowers appear in May and June. Hare's-tail cotton grass is somewhat similar, with many tufted stems and solitary terminal spikelets, which flower in April and May. In both species the floral envelope is formed of many long cottony hairs, the clusters when ripe appearing as a dense cottony tuft or head, 1 to 2 in. long and 1 in. in diameter (Fig. 8). The "cotton" is sometimes collected and used for stuffing pillows.

The cotton grasses will be reduced if the water-meadows in which they occur are generally improved by proper drainage, liming, manuring and grazing, with mechanical treatment if required, as suggested against rushes.

Sedges.—In general, sedges somewhat resemble grasses, both in the leaves and spikelets. A large number of species are known; they vary widely in their habit, some favouring dry soils and others wet ones. Common Sedge (*Carex goodenowii* Gay.) and other species of *Carex* are common, useless plants of damp meadows and pastures, water meadows, and by the sides of ditches and rivers. The common sedge (Fig. 9) is a perennial, with narrow erect leaves, and a rough, slender, stiff stem 1 to 2 ft. high. The spikelets are sessile, from ¼ to 1 in. in length, and placed three to five together on the axis or stem. The rootstock often creeps extensively.

Sedges that occur on wet soils may be reduced by the measures recommended against rushes.

Sedges of other species (*e.g.*, *Carex praecox* Jacq.) occur on

poor, dry pastures, and on moors, and may have a tufted or creeping rootstock. They more or less resemble the foregoing species. Several kinds with bluish-green leaves, resembling those of the carnation, are termed "Carnation-grasses" by farmers. On dry pastures, sedges should be cut regularly, and the herbage should be improved by mechanical treatment, liming, appropriate manuring and grazing.

* * * * * *

THOMAS HITT: AN EIGHTEENTH-CENTURY HEATHLAND FARMER

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THE lives of men whose writings, in the pre-scientific days of agriculture, have contributed to the development of farming practice are often obscure. What we know of them is usually limited to the theories and practices advanced in their books, in which, however, the authors sometimes intrude casual remarks about themselves that serve to throw a little light upon their lives. Probably these were no more exciting, although just as satisfying, as are, and always have been, the lives of practical men in any field of human endeavour.

The life of Thomas Hitt, the subject of this note, is no better documented than that of many other agriculturists of his period. He wrote two books—*A Treatise of Husbandry: on the Improvement of Dry and Barren Lands*; and *A Treatise of Fruit Trees*. The latter was published in 1755; the former appeared in 1760.

It has been stated that the author died about the year 1710, and that the books were published from manuscripts found after his death,* but this is very doubtful because of statements he himself makes in the books. Donaldson tells us that Hitt was gardener to Lord Manners, at Bloxholme in Lincolnshire, but this information is taken from the title-page of *A Treatise of Fruit Trees*. He adds that the author was a native of Aberdeenshire, and, after much serving as a gardener, became a nurseryman and designer of gardens in Kent.

Hitt, himself, says (in his *Husbandry*) that he served his apprenticeship at Belvoir Castle, a possession of His Grace the Duke of Rutland, and that he planted a warren on the estate with oak in the year 1724. At a later stage of the work,

* John Donaldson: *Agricultural Biography*, 1854, p. 54. Mary S. Aslin: *Catalogue of Printed Books on Agriculture, Rothamsted Experimental Station*, 1926.

he supplies observations on the seasons he had experienced. "The following are observations I have made," he says, "on the prices of corn and likewise of the seasons, as to their being excessive wet or dry." The series opens with 1727, when the summer was very wet, as it was also in 1728; consequently, prices rose, wheat from 4*s.* to 8*s.* per bushel and barley from 2*s.* 3*d.* to 4*s.* In 1729, the spring and summer were dry and corn was cheaper; in 1746, spring and summer were very dry and barley fell to 1*s.* 4*d.*; 1757 was a wet year. It is possible that these remarks may have been inserted by an editor, but, on the other hand, there is every reason to suppose that Hitt wrote them himself, so that the year of his death must have been much later than 1710. The preface to this book, indeed, is dated 1760, "Chislehurst, at the Right Honourable Lord Robert Bertie's," and confirms that Hitt spent part of his time in Kent. The imprint, moreover, states that it was printed "for the author."

The major portion of Hitt's life, however, as he tells us in the preface to the *Treatise on Fruit Trees*, was spent in Lincoln and Nottingham, where "the great part of my time I have had the honour to be a servant to some of that noble family (the Duke of Rutland's) who are all so willing to encourage a person who desires to improve his knowledge . . . my practice has chiefly been within twenty miles of Newark-upon-Trent . . ." He resided most commonly in Lincolnshire and Nottinghamshire after leaving Robert Sutton of Kelham.

The *Treatise of Fruit Trees*, of which the second edition appeared in 1757, was, Hitt claims, occasioned and promoted by several gentlemen who liked to spend some time in their gardens. It contains a catalogue of fruit, directions for draining, burning of clay, manuring, all the arts of pruning, describes walls and wall fruit, and instructs the nurseryman how to pack trees for transport. It also gives a list of instruments required by a dresser of fruit trees.

Hitt's places of domicile, in Lincoln, Nottingham and Kent, show us why his *Treatise of Husbandry* has the subsidiary title of "the improvement of dry and barren lands." His situation was such that the reclamation of heath and the improvement of sandy soils was, necessarily, his immediate pre-occupation. In spite of this, he feels it incumbent upon him to apologise for adding to the already long list of farming books. "After so many large and learned Treatises upon the subject of Agriculture," he says in the preface, "I imagine this will be thought superfluous; but as I write with an intent of being of

service and assistance to my country, that determined me to publish this Treatise . . ."

"What chiefly induced me to this Undertaking was a visible want of Men to defend His Majesty's Dominions, and the Poor complaining of the Scarcity of Bread." In all the country with which he was acquainted, there were large tracts of waste and warrens that might be reclaimed and cultivated, and the poor need not be denied the privilege of collecting furze for fuel on these wastes, because one acre of enclosed waste would produce as much brushwood as ten where animals graze. So far as his precepts were concerned, they were such as he had caused to be practised with good success; and he hoped many others would reap benefit from them.

The local backwardness of farming did not please Hitt. He had been told that land was left untilled for want of manure, even in places where lime could easily be obtained. The farmers thought dung the only possible manure; Hitt sings the praises of lime, soot, pigeons' dung and marl, and says that burning is good in many sorts of poor land. It adds salts by the burning of the grass roots, and opens clay. "Agriculture has always been a most useful employment for man," he says. "It is well known the Almighty sent Adam to till the land, and at this time it is a work still necessary for the support of human life. It is not, however, carried on in all places to such advantage as it might be . . ."

In open fields, the cultivation of which by the newest methods was often a matter of some difficulty, "the first improvement is to be made by enclosure (where it is possible to be done), then it will be in the power of the possessor to order it according to his pleasure . . ." The best meadows and pasture lands were, in his opinion, the class of land least capable of improvement, and if they would fatten a large ox in three or four months should always be continued in their existing state. The average pasture was, however, very capable of improvement, especially rough grazing. Trees should be planted on the mountains, and rabbits should be confined by stone walls. He admits that he has never carried out the reclamation of a warren, but has dealt with land of the same nature close to a warren, and estimates 10 per cent. as the profit derived from the work.

The system of reclamation he adopted was fairly widely known in his day, and was practised extensively during the expansion of the tillage area consequent upon the growth of population in the last quarter of the eighteenth century, and

upon the shortage of supplies caused by the bad harvests and the Napoleonic Wars.

Practical as was the advice contained in Hitt's *Treatise*, it must reluctantly be admitted, therefore, that his system was not original, although he may have been one of the first few men to try it out empirically. It had, indeed, been known for at least a hundred years. Gabriel Reeve, in *Directions left by a Gentleman to his Sons for the Improvement of Heathy and Barren Land*, 1670, says: "you shall see how an industrious man in Brabant and Flanders would bring five hundred acres of barren and heathy land, that was not worth at the most above fifty pound a year, to be worth seven thousand pound a year" (he was evidently more optimistic than Hitt) "in less than seven years. I know no reason why the like may not be done in England." He thinks the system would work on land like Sandy (? near Kingston-on-Thames) or St. Leonard's Forest, especially as "we have the advantage of marl and lime, which the Boores" [Dutch or Flemish peasants] "have not." His process was to break up the land with a strong team, cross plough, tear out the heath with a "great harrow," gather and burn it, dung with about 20 loads an acre, sow rye, then oats with clover, bush-harrowed in. An acre of clover, part mown and part fed green, would, he estimated, keep four kine summer and winter.

Reeve also describes experiments in paring and burning, followed by a dressing of lime, with turnips as a first crop. This book also is derivative, being almost a verbatim copy of Sir Richard Weston's *Discours of Husbandrie used in Brabant and Flanders*, second edition, 1652, and the system advocated by Hitt is also, to all intents and purposes, laid down in Gervase Markham's *Inrichment of the Weald of Kent*, 1625. It is probable that much the same thing is contained in *The Gentleman Farmer; or, Certain Observations made by an English Gentleman upon the Husbandry of Flanders, the same compared with that of England*, 1726, which is attributed to the Hon. Roger North, but which the writer has not yet seen, although it is mentioned in McDonald's bibliography and in a second-hand-book seller's catalogue.

Hitt's system was first to pare and burn. For the purpose, a breast plough or a paring plough was used; the latter was known as the Rockcliff plough in the Fens of Cambridge and Lincoln. It had a circular coulter, which moved on an axis fixed to the beam, and it was drawn by two horses. It was most expeditious on carr or moss land, but of no use on land having

many stones, etc. The other instrument was called by various names in different parts of England. In the north it was known as a floating or paring spade, in some places as a breast plough, and in others as a denshiring shovel. It was a broad spade with one edge turned up to form a sort of mouldboard and to cut off the turf, and the method of using was to push it forward from the thighs. It had a shaft some 7½ ft. long, with a fairly long cross handle which rested on the thighs, the latter being protected by wooden or leather harness. With this implement a good hand could pare about an acre in four days. The turves so cut off were stacked till dry and then burnt, the resulting ashes being scattered over the land to serve as manure. Hitt preferred this implement to the horse plough. On lands covered with ling, furze and old grass, sufficient improvements may be made by burning and proper tilling; and if they are pared with a breast plough, "it will have an excellent effect for then there will be more earth than if the land was broke up with a horse plough . . ."

"The land that cannot be pared with a breast plough, is such as is mixed with peeble, or other stones near the surface; for either of them injures the instrument, which ought to be kept extremely sharp." After this treatment, turnips or cole were sown and eaten off by sheep, then barley or oats the following spring, then wheat or rye, and, after that, grass seeds. If allowed to fall down, as it so often was, there was no improvement in the pasture. Hitt advocated 10 lb. trefoil and 1 lb. rye grass an acre, sown under the grain, as a good seeds mixture. Land treated in this way would produce plentiful crops of corn for three or four years, if required, and be in rich order thereafter for any sort of grass seeds. If the land had been burnt before the middle of May, barley might be sown at once; and if not a loose, deep sand, 4 lb. cinquefoil with the barley. On a farm worked on this system, there should be as many sheep as the land will keep because of the value of their manure by folding.

Wheat, if not sown with one of the drills, which were then really only in the experimental stage, should be sown at ten pecks an acre and ploughed in; the seed should be brined to prevent bunt, and compost was better than farmyard manure alone. On a new farm, the manure should be put on clover any time during the winter. Parsley, it is suggested, might be sown under wheat; it would make wholesome feed for the sheep for a whole year. Winter tares were good as a spring feed for sheep, milch cows or horses, when long enough to be mown.

Rye was, however, better on poor, dry lands. It was very useful grain for fattening hogs, or "to mix with wheat to make bread of; it renders it sweeter and less dry in the summer than wheat alone, and more esteemed by many."

Bush harrowing is recommended for young grass. A large thorn bush should be dragged by a horse all over the ground on a dry day; or, for want of a large bush, small ones may be used by fixing them in a harrow, gate, fleak or hurdle. This process was used for tearing out moss, and after winter-claying of the pasture. When old clover or other "artificial" grass had been pastured for five or six years, it might be ploughed for oats, followed by wheat or rye, and again laid down.

Such a system of farming on reclaimed warrens would, Hitt thinks, be very advantageous. He estimates that there were 100,000 acres of suitable land in one county alone, and suggests that 10,000 acres should be planted, the remainder being cut up into 500-acre farms. The results will be a large increase in population as well as profit to the landlord. In place of the 500 people required to look after the warrens, there will be an addition of 3,280 people, and to these again will be added the tradesmen necessary to supply their wants. Hitt has great reason to suppose that the corn raised upon these dry, sandy lands would be of extraordinary service, and that each farm of 500 acres would produce 100 quarters net.

There will, moreover, be an undoubted benefit to the landlord who sets about such work. An estimate for enclosing 500 acres of warren is supplied, and the cost of a house of four rooms on a floor, with a barn, stable, dove-house and other convenient outbuildings, also with a garden and orchard, fit for a farming tenant, at the highest rates, will be £300. This will allow the rent to be raised from 1*s.* to 5*s.* per acre, and, including an allowance for capital expenditure, the profit will be £55 10s. per annum, or three times as much as before. From the sportman's point of view, also, there will be an advantage, because the warreners destroy foxes and hares, and the rabbit burrows are dangerous to hunters.

On each of these farms, a flock of 500 ewes and their off-spring should be kept whereas only a few sheep are kept on the warrens in the summer. The wethers should be sold at two or three shear with culled ewes, *i.e.*, at about 60 a year; and a clip of 250 each year, or about five packs of wool, if the fleece is between four and five pounds, an obvious benefit to the country at large.

Another reason for doing this work was the shortage of rural housing. Many people were prevented from marrying by the want of habitations, both farmers' sons and men and maid servants. These unfortunates were forced to go to London, or other great cities, where few children were born. Moreover, milk was difficult to come by in the country, especially for the labourer unless he kept a cow; and the unstinted common pastures were overstocked by the rich commoners to his disadvantage and, indeed, to their own, although they conserved their supplies of winter feed by this means. Hitt thinks, therefore, that the heavy clay commons should be tilled, and old tillage ploughed up for grass. Many of the old enclosures might easily be improved.

The implements recommended for use on the farms reclaimed from the warrens were ploughs "such as can be used in sand land with only two horses abreast, and guided by reins, by the men that holds the plough." Both heavy and light harrows are necessary; and a roller will be extremely useful. The latter should be made of oak, 2ft. diameter and 5ft. long, and fitted with shafts like a cart. Elaborate details for the treatment of each field are supplied, and Hitt sets out the best size to make them for the purpose of following his ideal rotation.

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MARKETING NOTES

The National Mark: Address to the Birmingham Rotary Club.—*The following is a synopsis of an address which was given to the members of the Birmingham Rotary Club on January 26, 1931, by Sir Charles Howell Thomas, K.C.B., C.M.G., Permanent Secretary of the Ministry of Agriculture and Fisheries.*

In his introductory remarks, Sir Charles pointed out that in commerce the production of uniform and standardized commodities had been achieved through the evolution of businesses into large units. In agriculture, however, individualism had continued, comparatively little success having been attained by efforts to secure combination by co-operative enterprises. On the other hand, modern tendencies in other industries had been followed by oversea agriculturists in order to exploit the valuable market which existed in this country for their products. They had developed a system of marketing in which the dominant feature has been the presentation of their wares in uniform sizes and qualities and in standard packages so that bulk supplies can be easily handled. The result was that, in many cases, the wholesale markets had preferred imported supplies to home produce, which lacked uniformity in quality, methods of packing and regularity of supply.

To assist home producers to compete more equally with those abroad, and to reap the natural advantages of proximity to their markets, it had been the policy of successive Governments in recent years to encourage the reorganization of the marketing arrangements of our farmers, and it was in pursuance of this policy that the late Government passed the Agricultural Produce (Grading and Marking) Act of 1928, which gave birth to the National Mark Scheme.

The essentials of this scheme were the definition of official standards of quality (by regulations made under the Act of 1928), the encouragement of grading to those standards, as well as, where practicable, of packing in standard packages, and the sale of such standardized produce under one trade-mark—the National Mark.

The scheme was at present entirely voluntary, but authority to use the Mark was only granted to those who accept certain conditions designed to secure the efficient grading and packing of the products, so that the Mark might be associated in the public mind with only best quality home produce.

The policy of the scheme was advocated by all political parties, and not only was it sound statesmanship but it was

also good business. It had been developed and was being applied, commodity by commodity, after full investigations and discussion with the various interests concerned. With the exception of beef, the grading and application of the National Mark were carried out by the producers themselves, either as individuals or in association, or by other organizations and agencies specially authorized by the Ministry. In order to ensure that the standards of quality for the commodity were maintained at a reasonable level, authorization to grade and pack under the National Mark was only granted to those who had the skill, equipment and turnover to permit them to carry out the tasks involved efficiently and economically. Their work was subject to inspection by officers of the Ministry, and the system of labelling was such that the produce could always be traced back to the packing station without difficulty.

Apples and pears were the first home products to which the National Mark was applied—in the autumn of 1928. This scheme was now well established and the demand for high-class National Mark apples and pears far exceeded supplies.

Last year, experimental schemes were introduced for strawberries and cherries, with very satisfactory results. National Mark strawberries met with a very keen demand and their appearance on the markets, by example and contrast, stimulated the trade as a whole towards ending the "topping" and short-weight evils.

Tomatoes and cucumbers were other fruits to which the scheme had been applied with success, and there had been a definite improvement in the grading of both these products, not only by National Mark packers, but also by growers who, as yet, did not use the Mark.

A good start having been made with fresh fruits, the National Mark Scheme was extended last season to certain varieties of canned fruits, peas and beans. Many millions of cans bearing the National Mark had been packed during the past season and some of the leading packers had announced their intention of extending their operations considerably next summer. This was proving one of the most popular groups of commodities to which the scheme had been applied, retailers reporting that consumers had quickly appreciated the opportunity of obtaining their favourite English fruits in winter. The outlook for this scheme was, therefore, most promising.

The National Mark scheme for eggs, which was introduced in the early part of 1929, had given to egg producers a weapon

with which to combat the competition of imported eggs. As a result of the scheme, graded English eggs had not only gained entry into the wholesale markets where they were hitherto almost unknown, but they had gained the premier position in those markets. Over 200 million home-produced eggs were handled by National Mark packers last year. Egg production in this country was increasing rapidly, and the scheme was providing producers with up-to-date machinery for the marketing of their output.

A start had been made on an experimental scale with the packing and sale of dressed poultry under the Mark.

Under the National Mark, all-English wheat flour of standard quality had, for the first time, been placed on the market. The flour scheme had now been in operation for two seasons, and there were some 180 authorized millers and packers. The demand for this flour varied in different parts of the country, but as a result of the Ministry's publicity, of propaganda work undertaken by the National Farmers' Union among its county branches and by the Women's Institutes, who were arranging cookery competitions, its sale was extending steadily in country districts. A number of bakers now baked a loaf from all-English National Mark flour, and had reported a considerable increase in sales as a result of their enterprise.

Livestock raising was perhaps the most important branch of agriculture, and, with the continued depression in cereal prices all over the world, it was one to which our farmers were likely to devote more and more attention. The livestock industry had, however, to face severe competition from imported supplies, and particularly from chilled beef from South America. Considerable importance was, therefore, to be attached to the scheme for the grading and marking of home-killed beef under the National Mark which was introduced in London and Birmingham on a more or less experimental basis towards the end of 1929. The results had been so satisfactory—particularly in London—that, following the recommendation of a Departmental Committee which investigated the scheme last year, it had been decided to extend it to the Leeds, Bradford and Halifax areas.

It was very difficult for the average housewife to classify beef in the shop, and it was one of the advantages of the National Mark Scheme that the grade marks of the three grades were applied in such a manner that the mark was readily distinguishable on all the principal joints. Only beef

of good quality was graded under the scheme, and, in purchasing National Mark beef, the public could be certain that they were obtaining the best quality home-killed meat, while the distributor received, through the Mark, a hall-mark for his goods and retained the confidence of his customers.

Malt products, including malt extract with cod liver oil, were also available under the National Mark. A scheme for applying the Mark to cider had been introduced recently. National Mark cider would be placed on retail sale next May.

On the question of publicity for National Mark products, Sir Charles explained that, in introducing the National Mark Scheme, the Ministry recognized that it was not sufficient to provide a means for the standardization of home products; they must also be advertised and their benefits proclaimed.

The Ministry itself had carried out a strong programme of publicity during the past year, special attention being paid to the National Mark beef scheme in view of its rather exceptional nature. Every possible medium of advertisement had been used, including the national and local Press, posters on hoardings, in trams and on van sides, streamers on 'buses in London, slides in cinema theatres, displays of National Mark products at trade and other exhibitions, together with a new type of publicity in the form of National Mark Shopping Weeks, which had been held in a number of important towns.

It was very gratifying to find that packers themselves were also taking up the advertising of their products.

Dealing with the National Mark Scheme in its local application to Birmingham, Sir Charles said that, in common with other big centres of population, Birmingham was a city to which considerable quantities of National Mark goods found their way. Large supplies of National Mark fruit, particularly apples and strawberries, appeared in the Birmingham markets during the past season. Birmingham was selected as one of the two centres for trying out the National Mark scheme for beef. Unfortunately, progress had not been so satisfactory as in London, but with the aid of the extensive publicity campaign which the Ministry had been carrying out for the past nine months, the number of sides of beef graded and marked under the scheme had been on the increase, reaching a record total in the week before Christmas.

The value of the scheme to producers lay in the fact that it gave them, for the first time, an opportunity of selling their products on standardized lines. The increased public demand for these products encouraged farmers to produce high quality

commodities, and offered them the stimulus of steadier and, frequently, better prices.

Distributors had the advantage of dealing in standardized produce of uniform quality in bulk supplies. They could order on grade and sell with confidence. All this led to economical handling. The Ministry's supporting publicity assisted them to push sales with the certainty that the consistent quality of the commodities would give confidence to their customers. The Mark gave Government backing to distributors. They were accustomed to deal in branded goods, but in the past there had been no brand for much of our home agricultural produce. There was now available a definite brand—the Nation's brand—which distributors could push and advertise, as many of them were doing.

Consumers had, for the first time, an impartial guarantee of quality; they knew what they are buying. They could form the habit of buying by the Mark just as they were accustomed to buy by the brand in the case of certain household commodities.

In conclusion, Sir Charles said :—

"We all have an innate desire to help our Motherland. The National Mark Scheme gives us an opportunity to do so, without detriment to ourselves and in the knowledge that we are both deriving personal advantage by buying the best foodstuffs available, and ensuring employment for British workers, while helping those of our kith and kin who live by the products of our soil.

"I appeal to all present to become propagandists for the National Mark, the development of which will, I am convinced, mean much to all who are interested in our markets, either as home producers, distributors, or consumers.

"The national advantages resulting from the goodwill attaching to the National Mark are obvious, and I am sure that those advantages will be readily appreciated by, and commend themselves to, the business community generally."

National Mark Eggs : A Review of Progress.—The second year's working of the National Mark Egg Scheme was completed on January 31, 1931, and the occasion calls for some account of the progress of the scheme during that period. Two slight modifications of the original scheme were made during 1930. A regulation was introduced requiring the code-marking of all packages of National Mark eggs (except 1-doz. and ½-doz. cartons) with the date of packing, and the statutory

grades were increased to four by the addition of a lower weight grade. The other grade designations were altered simultaneously. The four grades for hen eggs are now:—Special or Special Weight, Standard or Standard Weight, Medium or Medium Weight, and Pullet or Pullet Weight.

In general, it may be said that during the first year of the scheme its effects have been extended and its influence increased. Apart from the fact that still larger quantities of home-produced eggs were graded and packed to National Mark standards, the scheme has now definitely established the National Mark egg as pre-eminent in the wholesale markets and has still further raised the level of efficiency in marketing technique.

The public is not yet fully educated as to the superior worth of graded eggs, and the difference in price of graded, as compared with ungraded, eggs is, in consequence, not so great as is warranted by their extra value. Partly owing to this, a number of authorized packers have withdrawn from the scheme, the number operating on January 31 of this year being 140, as compared with 150 a year previously. Nevertheless, the turnover of eggs packed under the Mark in 1930 was considerably higher than in corresponding months in 1929. Approximately 160 million eggs were packed under the Mark in 1930, representing over 70 per cent. of the total turnover of eggs sold by the packing stations. While the National Mark output represents only about one-twelfth of the production of eggs on farms in England and Wales, it obviously forms a much higher proportion of that part of the supply that passes through commercial channels. The scheme is bound to become more important each year in view of the increase of the home-produced egg supplies for which markets have to be found in the large centres of consumption where the demand is for standardized qualities, grades and packages.

An important development took place in February, 1930, when the authorized packers formed an organization known as National Mark Egg Central, Ltd., to act as a central co-operative selling agency, in order to widen the channels of distribution of National Mark eggs, and to secure the economies of large-scale, centralized distribution, with a closer adjustment of supply to demand throughout the country. The company has worked, through its accredited agents, in a number of large consuming centres, including London (where its agents have been members of the London Egg Exchange), Manchester, Liverpool and Birmingham. During

the period March, 1930, to January, 1931, the number of National Mark eggs handled by the Society's agents reached a figure of nearly 20 millions. These eggs were mainly supplies for which packers needed a new market, and the service that National Mark Egg Central, Ltd., has rendered to the home egg industry as a whole, in clearing this surplus through its agents without a severe break in prices, has been of the highest value.

In keeping with the downward trend in commodity prices during the year, egg prices have also fallen, but National Mark eggs have emerged in a relatively stronger position. The price margin, between National Mark eggs and the best imported eggs, that was secured in 1929, has been well maintained in 1930. The margin in favour of National Mark "Specials"—which roughly correspond in weight to the Danish 18-lb. egg—was noticeably higher in the flush season of 1930 than in that of 1929. An appreciable margin is observed when comparing the prices of National Mark "Standards" and Danish 15½-16-lb. eggs; in fact, taking monthly averages of National Mark Egg Central's prices for "Standards" and the Smithfield Market prices for Danish eggs, margins exceeding 5*s.* per 120 in favour of National Mark "Standards" were secured for a considerable period during last year. It is also noteworthy that the wholesale prices of National Mark "Standards" on the London market in 1930 showed a margin of up to 3*s.* per 120 over that of "first quality" ungraded English supplies. Incidentally, National Mark eggs are the only home-produced eggs the prices of which can be quoted throughout the country on recognized grades, and they are the only home-produced eggs quoted on the London Egg Exchange. They are also the only home-produced eggs that can be advertised nationally.

The indications are that the distributive trade and the public are becoming increasingly alive to the value of National Mark eggs, while, at the same time, the scheme is rendering valuable service to the producer. This is seen, for example, in the annual report of the Stonegate and East Sussex Farmers' Co-operative Society, Ltd., which has made an average price over the year for "Standards" of just over 2*s.* 1*d.* per dozen.

A striking feature of the year's operations has been the increase in output of some of the largest stations. Complete figures are not available for 1929, but the following statement shows the throughput of five of the largest packing

stations during 1930. Four of these stations are producer-controlled.

	Total Output millions	*Output under National Mark* millions
(1) Norfolk Egg Producers, Ltd., Norwich	8·4	8·0
(2) Wiltshire Egg Producers, Ltd., Hungerford	7·6	7·4
(3) Gloucestershire Co-operative Marketing Society, Ltd., Cheltenham	5·8	5·2
(4) Messrs. Williamson's, Ltd., London	5·5	4·8
(5) Melton Mowbray District Farmers' Association, Ltd., Melton Mowbray	4·5	3·9

An advance has been made in the output of National Mark eggs from the recognized "exporting" areas such as Cornwall, whence large supplies from a number of smaller stations are regularly consigned to London. Development is not, however, confined to "exporting" areas. A London example is given above, while the Sussex station previously referred to, which markets at short-range chiefly in the Metropolitan area, has also been able to record the doubling of its output as compared with the previous year. There are still a number of areas where no National Mark packing stations exist, and it is hoped that, in these areas, producers will take up the running and establish their own co-operative stations as soon as possible.

Mention should also be made of the attitude of the distributive trade. Apart from the activities of National Mark Egg Central, Ltd., and its agents, a number of wholesale firms deal regularly in increasing supplies of National Mark eggs; while, at the retail end, definite progress is being made. A typical instance is seen in the record of the Bradford Co-operative Society which, in 1930, disposed of 1 million National Mark eggs, no other English eggs being handled. Two or three years ago, the Society dealt almost solely in imported eggs — now National Mark eggs account for over 50 per cent. of their turnover! Again, in Birmingham the largest co-operative society in the City purchased, in 1930, nearly 2½ million National Mark eggs, and is reported to be intending to purchase much larger quantities in 1931.

A number of retailers are also developing their trade in one-dozen and half-dozen cartons. It is hoped to see a further increase in this trade, whereby the guarantee of the Mark on the package is carried right through to the consumer.

National Mark Poultry.—The Ministry has just issued a new leaflet (Marketing Leaflet No. 26) describing the Shenley Poultry Products, Ltd., National Mark Poultry Demonstration Station at Shenley Farm, Headcorn, Kent. This organization is a Co-operative Society, which was registered under the Industrial and Provident Acts in June last. The qualifications for membership include guarantees that a member's whole output of table poultry will be delivered alive to the Society after attaining a specified weight, and that the member will raise chickens for ten months in the year. The Society provides for the fattening, killing, plucking, shaping and cooling of the birds, which are subsequently graded according to weight and quality and marked by the attachment of the appropriate National Mark disc. They are then packed in single layers in non-returnable crates for dispatch to the markets. Many of these processes are illustrated in the leaflet.

In return for a grant from the Ministry, it has been arranged that the Society shall conduct interested persons round the station and explain to them the method of operation. Other producers may, therefore, have an opportunity to profit by the experience of this Society. Intending visitors are recommended to make an appointment in advance.

Copies of the leaflet may be obtained, free of charge, on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

National Mark Beef.—The weekly average number of sides (including quarters and pieces expressed in terms of sides) of beef graded and marked with the National Mark during January, 1930, and January, 1931, respectively, and the number of sides graded and marked for the four weeks ended February 14, 1931, were as follows :—

		Number of Sides
	LONDON	
Weekly average ..	January, 1930	1,193
" " ..	" 1931	1,944
Week ended ..	January 24, 1931 ..	2,149
" " ..	" 31, 1931 ..	1,797
" " ..	February 7, 1931 ..	1,729
" " ..	" 14, 1931 ..	2,133
	BIRKENHEAD*	
Weekly average ..	January, 1930	191
" " ..	" 1931	718
Week ended ..	January 24, 1931 ..	685
" " ..	" 31, 1931 ..	718
" " ..	February 7, 1931 ..	515
" " ..	" 14, 1931 ..	311

* Sides consigned to London.

		Number of Sides
	SCOTLAND*	
Weekly average	January, 1930	1,353
" "	" 1931	2,285
Week ended	January 24, 1931	2,276
" "	" 31, 1931	2,186
" "	February 7, 1931	2,213
" "	" 14, 1931	2,446
	TOTAL LONDON SUPPLIES (All Sources)	
Weekly average	January, 1930	2,737
" "	" 1931	4,947
Week ended	January 24, 1931	5,110
" "	" 31, 1931	4,701
" "	February 7, 1931	4,457
" "	" 14, 1931	4,890
	BIRMINGHAM	
Weekly average	January, 1930	437
" "	" 1931	467
Week ended	January 24, 1931	463
" "	" 31, 1931	481
" "	February 7, 1931	513
" "	" 14, 1931	469
	LEEDS	
Week ended	January 31, 1931	637
" "	February 7, 1931	663
" "	" 14, 1931	730
	BRADFORD	
Week ended	January 31, 1931	294
" "	February 7, 1931	380
" "	" 14, 1931	416
	HALIFAX	
Week ended	January 31, 1931	82
" "	February 7, 1931	94
" "	" 14, 1931	130

* Sides consigned to London.

There was a slight decrease in the quantity of National Mark beef on the London market during January, mainly owing to a general drop in prices in the middle of the month. The trade in chilled beef led the decline, and wholesalers in home-killed beef were shy of throwing supplies on a falling market. During the month, 21,908 sides of home-killed and Scotch-killed beef were graded and marked under the scheme.

From February onwards, better cattle from the straw-feeding areas come forward, and English beef at this period of the year is of exceptional merit.

The system of sale of gradable cattle from farm to abattoir on a grade and dead-weight basis has made further progress. Many more inquiries have been received from farmers, and there is now a regular supply of cattle reaching the market

from sales on this system. The insurance scheme against disease is in operation, and all wholesalers who are buying cattle under the system have taken out policies.

The National Mark beef scheme was inaugurated at Leeds and Bradford on January 26, and at Halifax on January 27. A most satisfactory start was made at each centre. During the first week, 1,013 sides of beef were graded and marked. The quality of the beef offered for grading at these centres was unusually high.

Report on the National Mark Scheme for Apples and Pears.—The apple and pear scheme has now completed its third season and may be considered to be firmly established. Most of the authorized growers realize that the advantages accruing from its operations are not necessarily to be found in any immediate or definite increase of returns to the grower, but rather in the general success and progressive improvement in marketing which is proving of benefit to the industry as a whole.

Judging from observations made at the Imperial Fruit Show at Leicester last October by authorized packers and by growers who applied there for authorization, there is no doubt that the scheme is not only firmly established but is moving forward by its own momentum. Its progress has certainly exceeded anticipations.

By drawing attention to the active demand for high-grade home-grown apples and pears, the scheme has induced growers to make more strenuous efforts to improve the quality of their crops. This has been welcomed by those County Authorities who are concerned with fruit production because of the support which it affords to their own efforts and the acceleration of the progress of their work which has resulted.

Authorized Packers.—During the first two seasons, 70 growers were authorized to apply the National Mark to apples and 9 to pears. During 1930, a further 27 have been authorized for apples and 9 for pears, making the present total of authorized packers 97 and 18 respectively. Last season's heavy crop of good quality pears may have been to some extent responsible for the relatively large increase in the number of pear packers.

Quantity Marketed and Standard of Production.—No definite information is available of the quantity of apples and pears marketed under the Mark, but information obtained from both growers and distributors makes it obvious that the total number of packages of National Mark apples has

steadily increased from season to season. During 1930, the position has been affected by the abnormal export of home-grown apples to Germany, Holland and Belgium.

At the beginning of the scheme, the growers packing under the Mark were mainly those who had previously graded and packed approximately to National Mark standards. Other growers, however, applied for authorization in respect of apples without a full realization of the meaning of the quality standards required by the scheme, and consequently found that the proportion of their total produce that reached National Mark grade was very small. The National Mark Scheme has undoubtedly been an object lesson to many growers of low quality fruit, and, largely as a result of National Mark propaganda, apple growers in all districts have been exerting every effort during the last two years to secure better quality supplies. The result of these efforts is now becoming visible, and it is probable that, although the apple crop in 1930 was only fairly good as regards total weight, the quantity of good grade apples marketed has been greater than in any previous season. This improvement in the standard of production, however, cannot yet be fully demonstrated in terms of National Mark packages. Large-scale growers who are now producing high quality fruit, and who are changing over to packing in accordance with the National Mark regulations, find that the organization of grading and packing staffs is a matter of great difficulty. Hence, it will be two or three years before the whole of the output of such growers can be marketed under the National Mark.

Distribution of Supplies.—In the first year of the scheme, the distribution of National Mark apples and pears was almost wholly confined to the London and Manchester markets. The publicity which has been undertaken and the advertising power of National Mark apples themselves have created a live interest in the scheme in practically all provincial markets, with the result that, in the second season, limited supplies reached all the principal midland and northern provincial markets. During the 1930 season, several authorized packers made determined and successful efforts to decentralize distribution, and their consignments of National Mark supplies to the smaller markets stimulated local interests and met with a keen demand.

Inspection of National Mark Supplies.—Visits to packers and markets in connexion with the scheme have been regularly undertaken by the Ministry's staff, and it may be said that the

standard of quality of National Mark apples and pears has been well maintained during the season. It is noteworthy that a general improvement is taking place in grading and packing, owing to increased experience of packing operatives and closer supervision of their staffs by authorized packers.

Amendments to Scheme.—As a result of experience gained in the working of the scheme, certain minor amendments were effected before the 1930 season. The most important amendment was the abolition of "C" grade dessert apples, which may not now be packed under National Mark labels.

Packages.—The schedule of approved packages drawn up at the outset of the scheme appears to have met requirements, and very slight variations have been necessary. It is notable, however, that growers prefer non-returnable packages and are very reluctant to use returnable packages with the National Mark. This indicates a definite advance in marketing practice. It can seldom be advantageous to market graded apples in the same type of package as is used for ungraded supplies.

Labels.—National Mark apple and pear labels seem to have given complete satisfaction to authorized packers and to salesmen, and no complaints have been made on the score of cost or suitability.

General.—The statutory grades and the conditions governing the application of the Mark will be adhered to in the coming season, and there is every indication that the scheme in its present form will continue to operate with growing success and widening influence in the industry.

National Mark Strawberries and Cherries.—Following a consultation on the schemes with the relative Sub-Committee of the National Farmers' Union, it seems unlikely that any restriction will be imposed as to the varieties of strawberries that may be packed under the Mark during the 1931 season.

The question of making further additions to the types of containers which may be used under the National Mark Schemes for strawberries and cherries, including some new types of punnets, is under consideration.

National Mark Cider.—It has been decided, on the recommendation of the National Mark Cider Trade Committee, to modify the condition regarding the total annual "throughput" of cider of all kinds which must be attained by persons or firms desiring to become enrolled in the National Mark Scheme as "authorized bottlers." The "quantity qualification" has now

been fixed at 2,000 gallons per annum, instead of 3,000 gallons as at first proposed. The figure is, of course, tentative and subject to review in the light of experience.

The following additional firms have been recommended for authorization under the Scheme :—

Gloucester : Wickwar Cider Co., Ltd., Wickwar.
Hereford : J. Boulton & Sons, Ltd., Barrs Court Cider Works, Hereford.
H. P. Bulmer & Co., Ltd., Hereford.
London : Wm. Gaymer & Son., Ltd., 581–589 Hackney Road, E. 2.
Norfolk : Wm. Gaymer & Son, Ltd., Attleborough.

Publicity for National Mark Produce.—The first National Mark Shopping "Week" of the year was held at Derby, from February 4 to 14, concurrently with the Derby Homes and Industry Exhibition, at which the Ministry staged a display of National Mark products. The Exhibition was opened by Sir Thomas Middleton, K.C.I.E., K.B.E., C.B., Vice-Chairman of the Development Commission. The "Week" was well advertised by means of hoarding posters and press advertisements; local activities included a window-display competition and an essay competition for the senior school children, for both of which the Ministry offered prizes.

Following the advertisement of the National Mark Egg Scheme in producers' journals towards the end of 1930, advertisements of National Mark eggs were inserted in the principal journals circulating amongst retail grocers and dairymen. Further publicity is also being given to National Mark flour by means of advertisements in certain of the more important newspapers in the Eastern Counties.

National Mark beef is being regularly advertised in Birmingham, Leeds, Bradford and Halifax by means of press advertisements and in other ways, in order to stimulate demand in those areas. One enterprising retail butcher in the London area has had prepared a short film advertising National Mark beef which is being shown in a local cinema theatre for twelve months. This is but one of many instances of individual advertising of National Mark products which have recently come to the Ministry's notice.

Two new leaflets, on the subject of National Mark flour and National Mark eggs, respectively, have been issued by the Ministry. The former—Marketing Leaflet No. 12E—contains a recipe for making bread with National Mark All-English Yeoman flour on a commercial scale, based upon tests, made on behalf of the Ministry by the Director of the National Bakery

School, with a number of samples of flour produced from Yeoman wheat of the 1930 crop drawn from all parts of the country. Arrangements have been made for copies of the leaflet to be placed in the hands of practically every baker in the country. Marketing Leaflet No. 6G is intended mainly for supply to retailers of National Mark eggs for distribution to their customers. It contains some fifty recipes for egg dishes, preceded by the following foreword :—

It is not so many years ago that the breaking of an egg was attended by some amount of speculation as to what the nature of the contents might be. Improvements in marketing methods have, however, raised enormously the general standard of eggs placed on sale. The most notable advance in this direction was made when the National Mark scheme was applied to home-produced eggs of the finest quality.

In a relatively short time National Mark eggs have deservedly gained a prominent place in the markets of the country, even in quarters where formerly home-produced eggs maintained but a precarious footing in competition with carefully selected and graded imported supplies. The reason for this is not far to seek. The consumer always prefers home produce provided that it can easily be identified as such, that its quality is reliable, and its price reasonable.

National Marks eggs are guaranteed to be clean, home-produced eggs of first quality. They are inspected before a high-power lamp before packing, and no stale or defective egg passes this test. After inspection, they are graded into four weight grades :—

SPECIAL weight, a very large, special, breakfast egg.
STANDARD weight, a large egg. Egg-cups are designed for this size and cookery recipes are based on eggs of this weight.
MEDIUM weight, a medium-sized, all-purpose egg.
PULLET weight, a small egg, suitable for children and invalids.

Every National Mark Egg Packer is registered, and his premises and eggs are subject to Government inspection.

Since the quality of eggs is not apparent to the housewife until they are broken, the fact that National Mark eggs are all tested shortly before they leave the packing stations provides a valuable safeguard. It is most important in preparing egg dishes to bear in mind that the consistency of the albumen in the eggs has a very considerable effect on the result. This consistency weakens with age and with depreciation in quality of the egg, and the best results cannot be obtained by the use of so-called "cooking" varieties. By buying National Mark eggs you can be sure of securing home-produced eggs of uniform high quality, clean, sound, graded as to weight, and packed according to the most approved modern methods.

All grades are of first quality : the difference in grades is a matter of weight only. There is a difference of more than ½ lb. between a dozen eggs of "Special" grade and a dozen eggs of "Pullet" grade ; this difference is reflected in the price.

The National Mark is your guarantee of value for money.

Look for it on the egg-case or carton—*not on the eggs.*

Copies of the above-mentioned leaflets may be obtained, free of charge, on application to the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W. 1.

Displays of National Mark and other Home Produce.—At the British Industries Fair, Olympia, London, February 16-27,

part of the England and Wales stand was devoted to a National Mark egg grading and packing demonstration, one of the latest types of grading machine being used. The rest of the stand comprized a representative display of home produce.

The England and Wales occupancy of the Empire Marketing Board's shop in High Street, Birmingham, referred to in last month's issue, came to an end on February 7, after a very successful fortnight. The shop attracted a crowd of visitors every day, and keen interest was displayed by both the general public and the traders of Birmingham. A wide range of home-produced foodstuffs was displayed and samples of many of the commodities were on sale, including National Mark eggs, apples, flour, pharmaceutical malt extract; also canned fruits and vegetables, canned fish, tinned milk, tomato chutney, etc. The total number of separate samples sold was 25,006. An egg grading and packing demonstration, given daily by the Cheltenham Egg Packing Station, proved very attractive; and the Empire Marketing Board's cookery demonstrations were also well attended. There is every reason to hope that the sale of home produce in the Birmingham area will receive a considerable stimulus from this undertaking.

National Mark produce was displayed at the Derby Homes and Industry Exhibition (February 4 to 14) in connexion with the National Mark "Week" held in that town, and also at the Shire Horse Show, Agricultural Hall, London (February 24 to 26).

The Collective Advertising of Dutch Horticultural Produce.—The following translation of a recent article in a German journal is of special interest in view of the publicity now being undertaken in this country on behalf of National Mark and other home products. The *Preisberichtstelle beim Deutschen Landwirtschaftsrat* reports:—

For a good many years past, the management of the co-operative auctions in Holland have had in operation a system of collective advertising for Dutch produce such as vegetables, fruit, potatoes and, in certain cases, flowers. An advertisement fund has been created which derives its income from contributions made by the co-operative auction markets. The contribution consists of $\frac{1}{20}$ per cent. of the turnover during the previous year. In the year 1930, the receipts from this source amounted to 46,000 Dutch florins (approximately, £3,805); from the previous year there was a surplus of 17,000 fl. (approximately £1,406), which, together with reserves, resulted in a total sum of 77,000 fl. (approximately £6,370), being available.

In North Holland, 10,000 fl. (approximately £827) were devoted to the advertisement of the produce of the province, and, in Westland, a special fund of 7,000 fl. (approximately £579) for the advertising of grapes was contributed by the 12 co-operative auctions that have formed a special society in that province. The particular advertising campaign financed from these two sources extends to cabbages, tomatoes and grapes. The methods used included the sending of samples of cabbages to America and England, of grapes to India, of tomatoes to America, and of early potatoes to the Rhineland and to Westphalia. In the latter case, and in order to interest wholesale and retail dealers, extended use was made of advertising posters on pillars and walls and of advertising cards.

The collective advertising organization, referred to in the first paragraph of this note, made use, for the most part, of time-honoured methods. For furthering consumption in Holland, 500,000 pamphlets containing recipes were distributed to retailers; posters, advertisements on business letters and on envelopes, and other similar means were utilized, including illuminated signs in the large towns.

Dutch opinion regards the results as good. Particular attention was given to the display, in trains and trams, of seasonal advertisements for special produce. As soon as a particular Dutch horticultural product came into season, advertising cards were hung up in the trams in the large towns, and also in business houses or on the railway, drawing attention to it. For example, this plan was adopted during the season for hot-house tomatoes and for tomatoes grown under glass without heat. The general opinion was that, in the case of tomatoes, noticeable success was achieved. It should be mentioned, however, that, in the case of tomatoes, advertising posts in the streets were widely used. With grapes, illuminated advertisements in the main street of the seaside resort of Scheveningen were employed.

Advertisement abroad appears to the Dutch to be specially necessary, because consumption abroad has decreased in the last few years on account of the difficult economic situation in those countries that have been regarded as the chief market for Dutch produce. Holland took part in the exhibition in Zürich, with the result that Switzerland became an important consumer of Dutch produce. Holland also took part in the exhibition in Antwerp. Advertising posters for Dutch wares were also distributed in foreign countries and particularly when the season for important Dutch produce was beginning.

Marketing Grants.—In the issue of this JOURNAL for September, 1930 (pages 597–8), there appeared a list of grants authorized by the Ministry up to the end of June, 1930, out of funds made available by the Empire Marketing Board for the improvement of marketing of agricultural produce. Applications for grants of this nature have to be supported by evidence indicating that the venture contains some novel element and that it involves a commercial risk that would not normally be accepted by the applicant. Grants may also be made either in aid of specific items of marketing research undertaken on the Ministry's behalf or in return for certain services.

The following further sums have been granted by the Ministry during the half-year ended December 31, 1930:

Amount	To Whom Payable	Purpose
*£42 for 1 year to March 31, 1931	Wiltshire Egg Producers, Ltd.	To provide costings data in respect of egg packing station.
*£42 for 1 year to March 31, 1931.	Norfolk Egg Producers, Ltd.	Ditto.
*£42 for 1 year to June 30, 1931.	Cumberland Poultry Farms, Ltd.	Ditto.
*£42 for 1 year to March 31, 1931.	Melton Mowbray and District Farmers' Association.	Ditto.
*£31 10s. for nine months to March 31, 1931.	Gloucestershire Marketing Society, Ltd.	Ditto.
*£680 for 1 year to Sept. 30, 1931.	University College of Wales.	Marketing (advisory and statistical) investigations.
*£800 for 1 year to September 30, 1931.	Cambridge University.	Pig recording.
*£688 for 1 year to July 31, 1931.	Oxford University (Agricultural Economics Research Institute).	Investigations into the marketing of farm produce.
£350.	Shenley Poultry Products, Ltd.	To meet additional costs incurred while acting as a poultry packing demonstration centre.

* These are in continuance of grants previously made.

Compulsory Marketing in Queensland.—The latest Report of the Director of Marketing is a brief résumé of the operations of the fifteen commodity marketing boards in Queensland during the year ended June 30, 1930. These boards have been established under the Primary Producers' Organization and Marketing Acts, 1926–1928, and the Fruit Marketing Organization Act, 1923.

The past year has seen interesting developments in one or two commodities. Barley producers in the past have been unable to secure the whole of the brewers' trade in malting barley. This has not been because of the poor quality of the malt from Queensland barley, but rather because of the inability of the home producers to furnish an adequate supply from year to year. To remedy this the Barley Board was established, and already an arrangement has been made between the brewers and the board for the disposal, for malting purposes, of the whole of the unsold portion of last year's crop. It is expected that all the malt used in Queensland will, in future, be made from Queensland barley.

The Cotton Board during the past year has acquired the ginning plant of the British-Australian Cotton Association. The ginning and oil-milling operations will now be under the control of the Board.

The Wheat Board has come to an agreement with the milling interests for the purchase of between 3½ and 4 million bushels of Queensland wheat at prices based upon Sydney quotations.

Ownership of the various commodities is vested in the boards, but in most cases the pooled crop is marketed through the ordinary trade channels; the activities of the boards are chiefly confined to regulating the volume of supplies going on to State, inter-State, and overseas markets, providing for equalization payments to producers and fixing the commission charges to be made by the marketing agents.

It is regarded as evidence of the general satisfaction on the part of the producers that no board once established has been discontinued. In the case of some commodities, *e.g.*, butter and cheese, the boards have been renewed for further periods without any opposition, and in other cases ample majorities in favour of continuance have been forthcoming.

The Mark Potato Movement in Germany.—The German "Mark Potato Movement," which was briefly described in these pages in the issue of March, 1930 (p. 1193), has progressed steadily since its inception two years ago. The Hanover Mark Potato Association, which was the pioneer in the movement,

increased its sales from 120 truck-loads in 1928 to 250 in 1929, and to 280 up to November 20 in 1930. Similar organizations are now operating in the Provinces of Westphalia, Saxony and Silesia, and the Free States of Lippe, Saxony, Wurttemberg and Bavaria. As the result of a joint agreement, all the Mark Potato Associations are now marketing their produce under the same standards as those originally established in Hanover. They have adopted, in addition, a uniform " Eagle " brand with the words " German Mark Potatoes," in conjunction with a special Association Mark in each case, as shown on the specimen label reproduced below.

NOTE: The buff-coloured label is printed in black with the exception of the shield which is red, the figure of the horse showing buff on this.

In the control system of the Mark Potato Associations, an attempt is being made for the first time in Germany to give buyers of potatoes some guarantee of uniformity of variety and dressing in their purchases. Certain varieties only are permitted to be sold under the Mark, and there is strict

inspection both of the growing crop and of individual consignments. This implies in some measure a guarantee of eating quality, although it is recognized that, in this respect, the influence of such factors as soil, manures and methods of cultivation is not yet adequately understood.

Special care is taken to market the potatoes in as attractive a way as possible. They must be sold in new, sealed sacks, each bearing a branded label with a control number. An interesting recent development is the sale of Mark potatoes in 5-lb. and 10-lb. paper packages bearing the Mark; although this trade is still in the experimental stage, it appears to promise well and to meet a definite demand on the part of the German housewife.

The success of the Mark Potato Movement must depend ultimately on whether the producer is adequately rewarded for the extra costs of producing a high-grade commodity. Hitherto, this appears to have been achieved, and the trade has willingly paid a premium for Mark Potatoes, averaging about 6*d.* a hundredweight without sack; as against this, it is estimated that the extra cost of preparing Mark Potatoes for market amounts to about 4*d.* a hundredweight.

Strictly speaking, the Mark Potato is a luxury article, to the preparation of which very special care has been applied. The supplies have come hitherto, and are likely to continue to come, from a small minority of the most capable and progressive producers, consisting largely of seed-potato growers who are accustomed to the observance of a very high standard. In spite of its valuable educational effect on growers and the trade, the German Mark Potato Movement has apparently its limitations under existing conditions.

Potato "Futures" Exchange.—The first "futures" exchange for potatoes in the world has been started in Chicago, according to the bulletin of the *Preisberichtstelle beim deutschen Landwirtschaftsrat.* The first business done was in March deliveries of Idaho Russets, the most popular American variety. The official U.S. No. 1 grade has so far been recognized as a satisfactory basis for deals in futures. Prices are quoted in dollars per 100 lb., and the smallest unit that can be dealt in is one waggon of 360 sacks of 100 lb. each. Delivery must be made to one of the two goods stations in Chicago.

This experiment should certainly be closely watched by the potato trade, and especially in Europe, where, except for grain, there has hitherto been practically no organized trading in

futures in any locally grown agricultural produce. It will be interesting to see whether potatoes, which are so much more perishable and difficult to grade and transport than grain, can, in the long run, be successfully handled on a "futures" market, and whether a stabilization of prices will result.

The American Marketing Act.—The following excerpts are taken from a Press release of an address by Mr. Alex Legge, Chairman of the Federal Farm Board, to the College of Agriculture, University of Illinois :—

"The prime object of the Agricultural Marketing Act is to place agriculture on a basis of economic equality with other industries. Producer co-operation is the chief means provided for bringing about that result. Our job, as well as that of all other agencies interested in the betterment of agriculture, is to assist farmers in every way possible to make the co-operative programme effective."

"The Agricultural Marketing Act offers Government assistance to the farmer in obtaining what are, perhaps, his greatest and most immediate needs—a marketing system operating in his interest and the adjustment of production to the probable consumer-demand. Of these, perhaps the more important is the latter, for even a perfect marketing system will not return the grower a satisfactory price if he produces a quantity far in excess of the market demand. On the other hand, production of the quality and quantity that the consumer wants will not give the best results unless the marketing machinery is operating in the interests of the producer. The attainment of both, we believe, becomes reasonably easy through organization, but appears hopeless with 6½ million farmers acting individually and without regard to what their neighbours are doing. Organization has been recognized as a necessity in other lines for a long time. To be on an equality with highly organized industries, farmers, too, must be organized."

"This Act is not a relief measure. Congress discarded all the proposed schemes for artificially raising the price of farm products in favour of a plan to assist farmers, acting collectively, to control their industry and put it on a sound financial basis. In this Act, Congress says to the American farmer that the Government stands ready to help him just as far as he is willing to go in controlling his own industry."

* * * * * *

THE CONTROL OF THE CABBAGE ROOT FLY

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OF the insect pests that occur in more or less serious numbers each season, none is more persistent in its attacks or occasions greater loss than the Cabbage Root Fly (*Chortophila brassicae* Bché). This insect has received a good deal of attention during the last quarter of a century, and a fairly detailed knowledge of its life history and habits has been worked out.* Several methods of control have been advocated from time to time, and some of them have proved quite efficient under experimental conditions. In spite of this, however, severe injury to market garden and field crops is still prevalent, and in general little is done towards checking the loss.

Host Plants.—Cauliflowers appear to be especially susceptible to attack by the Cabbage Root Fly, possibly because the time of setting out in the early summer coincides with the appearance of the spring swarm of flies, and the drought that is often a characteristic of this season prevents the plants becoming established quickly and renders them less resistant to insect attack. Summer cabbages are subject to severe infestations, and turnips, swedes and radishes are commonly attacked. Other plants that may be attacked from time to time are autumn-set cabbages, Brussels sprouts and Swiss chards, and such flowers as wallflowers and stocks. Weeds also harbour the pest, and among the wild host plants are charlock, wild mustard, garlic mustard and shepherd's purse.

Types of Attack.—In the most common form of attack, the eggs are laid either singly or in small clusters in cracks in the soil near the plants, or in the crevice around the stem when the wind has slightly rocked the plants. On hatching, the maggots descend to the base of the stem and feed among the young roots near their junction with the main roots and the stem (Fig. 1). As the maggots develop, they destroy the roots until only a blackened, decaying, snag-like root devoid of lateral branches is left, and the maggots may be found more or less embedded in the decaying stem tissue.

A second type of attack occurs on turnips and radishes where the maggots make tunnels in the fleshy "roots." This mode of attack is fairly general, but does not seem to cause such serious losses as attacks on cabbages and cauliflowers. Possibly

* *Vide* Ministry of Agriculture Advisory Leaflet No. 18.

owing to the rapid growth made by these plants the maggots seem to have difficulty in finding suitable food, for they wander extensively in the tissue of the host plant and appear to do a considerable amount of feeding before reaching maturity. Similar winding tunnels may occur in the fleshy stems of cabbage and cauliflower plants, but this is not normal and the injury is practically negligible.

A third form of attack by the Cabbage Root Fly occurs when the eggs are laid, not in the soil, but somewhere about the head of the plant. On hatching, the maggots work their way into some suitable site in the upper part of the plant. This type of attack has not been widely observed, but was noted on cauliflowers in Lincolnshire in 1923,* and has occurred on swedes in Lancashire and North Cheshire during the seasons 1928-30.†

In the attack on cauliflowers, the maggots were found tunnelling in the fleshy branches of the curds. The infested plants produced open curds and were consequently unmarketable, and the bacterial rot which followed the maggot injury accentuated the loss.

In July, 1928, the writer's attention was drawn to a yellowish, moist rotting about the growing points of half-grown swedes, and examination showed that the rot appeared to be the result of attack by maggots which, when bred out, proved to be Cabbage Root Fly. The maggots were tunnelling into the fleshy bases of the leaves and often into the "root" below the growing point, six to ten maggots occurring on a single plant. As the result of the attack some putrefaction occurred amongst the swedes, but did not become serious because the season was dry. Many plants could be found in which the terminal bud was destroyed and a small hole, often hidden by the growth of axillary buds, led into a larger cavity in the neck of the swede (Fig. 2). When the crop was lifted approximately 60 per cent. showed more or less serious rot penetrating from the neck inwards. Subsequent observations of other swede crops showed that similar attacks of varying degrees of intensity occurred throughout Lancashire and North Cheshire.

In 1929, eggs of the Cabbage Root Fly occurred from early June onwards until early September on the upper surfaces of the stems of swedes, usually singly or in twos. The maggots entered the stems near the point where the eggs were laid, or wandered down and entered near the axil. In some instances, the maggots tunnelled through the stem from the upper to the

* Annual Report, Kirton Agricultural Institute, 1923.
† *Agricultural Progress*, Vol. VII, p. 54.

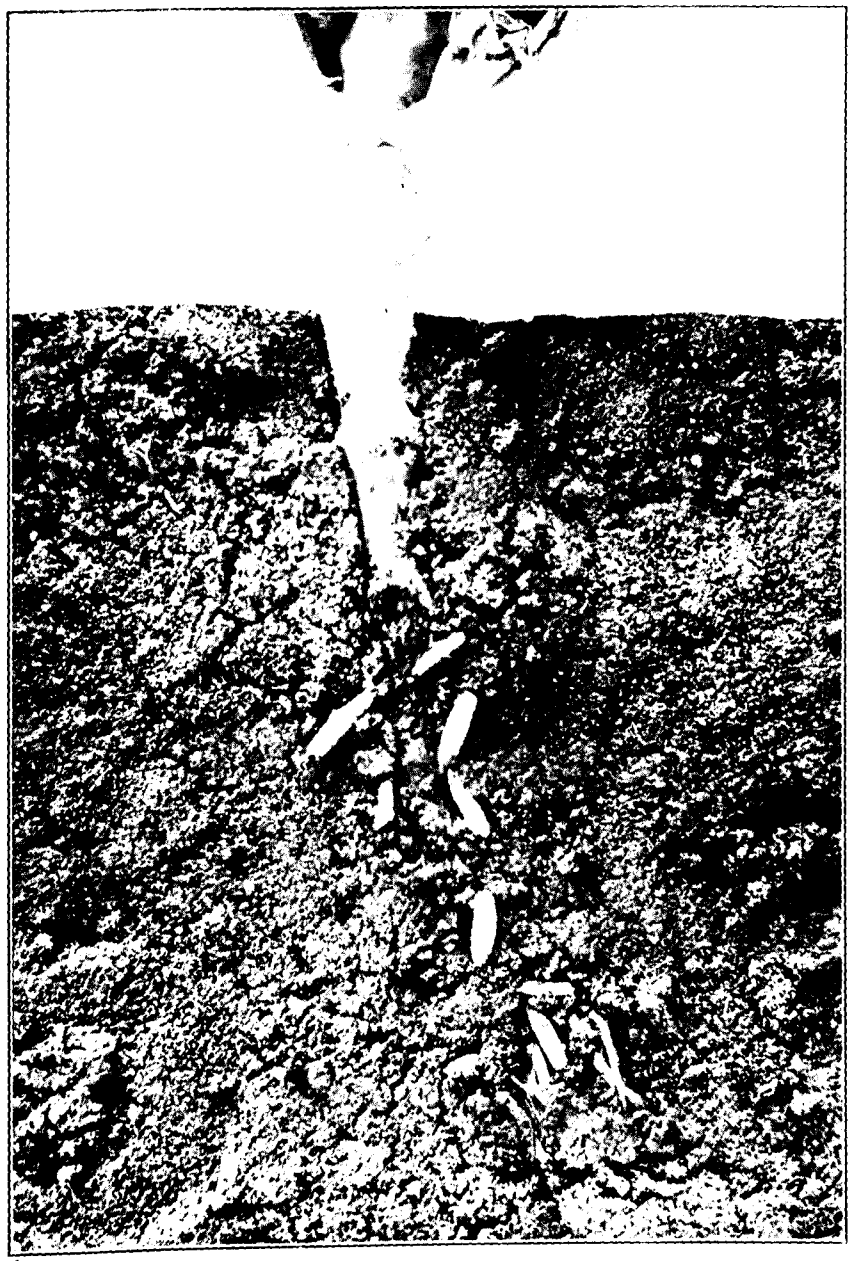

FIG. 1. Normal attack by maggots of the Cabbage Root Fly. Summer Cabbage plant with maggots feeding on the root.

THE CONTROL OF THE CABBAGE ROOT FLY.

To face page 1228.

FIG. 2. Cavity in neck of Swede following attack by maggots of the Cabbage Root Fly. Bacterial and other rots followed the initial wound caused by the maggots.

FIG. 3. Gaping wounds with yellow and brown decaying tissue in leaf stalk of Swede following entrance and attack by maggots of the Cabbage Root Fly.

FIG. 4. Result of treating cauliflowers with corrosive sublimate to prevent attack by the Cabbage Root Fly. At extreme right is seen a check row in same, damaged by untreated rows.

lower surface, and in others they entered the stem and turned downwards towards the base. At the point of entrance of the larvae, a circular or elongate wound developed, which gradually became filled with loose brown rotting tissue (Fig. 3). When the point of entrance was distant from the axil, the maggot reached maturity in the leaf stalk, but, when it occurred near the base, the maggot frequently tunnelled beneath and destroyed the terminal bud. The destruction of the terminal bud resulted in the development of axillary buds and caused a many-necked condition like that associated with attack by swede midge. Sometimes a bottle-necked condition occurred, similar to that described by Walton* as following midge attack. As a result of attack by Cabbage Root Fly, the swede crops in the north-western counties suffered severely from "neck rot" both in the field and, later, in storage.

Control Measures.—Among the control measures constantly recommended are the judicious rotation of crops, the avoidance of excessive cropping with cruciferous crops and the thorough cultivation of the land in autumn and winter. The value of inter-cultivation, hoeing, earthing-up and applying light dressings of forcing artificial manures is also well known, and, on most successful market gardens and holdings, close attention is paid to these operations. The value of insecticidal treatments is, however, less well known and forms no part of general practice. During the past three years, demonstrations of direct insecticidal and repellent treatments have been carried out in Lancashire and Cheshire and convincing results obtained.

The Use of Corrosive Sublimate.—Corrosive sublimate or bichloride of mercury was mentioned in connexion with the control of Cabbage Root Fly as long ago as 1864, but it is only within the last 15 years that serious attention has been given to its use. It is now the standard control measure in America and Canada, and appears to be consistently beneficial. It is a white crystalline powder that dissolves very slowly in water. Being highly poisonous, it must be handled with great care, and since it corrodes metals it should be used in enamel, wooden or glass receptacles. Though toxic to plants when used at high concentrations, it is harmless when used at dilutions of 1 in 2,000 or 1 in 1,000.

The following procedure has been adopted for small-scale work in gardens. The corrosive sublimate was weighed out into ¼ oz. lots and packeted. Each ¼ oz. packet was sufficient for 2½ gal. of water, this amount being chosen for convenience of

* This JOURNAL, September, 1927, p. 547.

mixing in a 3-gallon pail. After thorough stirring, to dissolve the corrosive sublimate, the solution was applied by means of a small tin pressed out to form a lip and nailed to a strip of wood about 18 in. long. Such a ladle proved very satisfactory for the application of the solution. About ¼ pint was allowed for each plant and applied so as to flood the soil evenly around the base of the plant. The solution was applied three to five days after the setting of the plants and repeated, at least twice, at intervals of seven to ten days.

For market garden use, where a larger area was to be treated, the solution was made up in a 40-gallon barrel, 4 oz. of corrosive sublimate being dissolved in hot water and added to complete the bulk.

In the accompanying table, details are given of the results of one of the demonstrations carried out in 1929 on cauliflowers (Fig. 4) :—

Plot	*Healthy plants*	*per cent.*	*Injured plants*	*per cent.*
No. 1—				
Treated	290	94·1	18	5·9
Control	31	44·3	39	55·7
No. 2—				
Treated	296	96·1	12	3·9
Control	18	28·1	46	71·9
No. 3—				
Treated	317	92·9	24	7·1
Control	36	62·0	22	38·0

Average for treated plots 94·4 per cent. healthy ; 5·6 per cent. attacked.

Average for check plots 44·8 ,, ,, 55·2 ,, ,,

In 1930, a similar demonstration was conducted under market garden conditions, and records were kept of the materials used and the time required. The following are the details :—

40 gal. of solution containing 4 oz. corrosive sublimate		
Number of plants treated	1,200	
Approximate quantity for each plant ..	¼ pint	
Total cost of solution	2*s*. 10½*d*.	
Cost of solution for 1,000 plants		2*s*. 5*d*.
Time required for treatment: two men working one hour:—		
Cost, at 9*d*. per hour..	1*s*. 6*d*.	
Cost of labour for treating 1,000 plants		1*s*. 3*d*.
Total cost of labour and solution for 1,000 plants.. ..		3*s*. 8*d*.

In this demonstration, the number of attacked plants was reduced from 47 per cent. to 13 per cent. by a single treatment ; thus an additional 300 plants were available for marketing in each 1,000 set out.

These demonstrations give definite indications of the value of corrosive sublimate against the Cabbage Root Fly and, where the method can be employed, it is well worth adoption as a routine treatment. For small scale operations, where it is thought inadvisable to purchase quantities of corrosive sublimate in powder form, the material can be obtained from chemists and druggists in tablet form. Four tablets per gallon give the required concentration of 1 in 1,000.

The cost of the corrosive sublimate treatment and the difficulties attendant on the employment of a liquid render this method of controlling Cabbage Root Fly unsuitable for application on a field scale. There is, therefore, a need for a simpler and cheaper method of control, and to meet this need experimental work is in progress at Manchester University. Preliminary trials have been carried out, using naphthalene, applied in dry crystalline form, and commercial, light creosote absorbed in precipitated chalk, and other suitable carriers. Both these materials have given indications of their value as repellents when applied a day or two after setting out the plants, the dressing being repeated, at least twice, at weekly intervals. The naphthalene is applied by hand to the soil about the plants, 15 lb. being sufficient for a single dressing for 1,000 plants. The creosoted chalk dust is applied by means of a knapsack duster, 2 lb. being sufficient to treat 1,000 plants at each application. Should these materials, upon further investigation, prove satisfactory, they will be suited for use as repellents against Cabbage Root Fly on cauliflowers, cabbages and swedes grown under ordinary field conditions.

The writer's acknowledgments are due to Messrs. N. J. Macpherson and W. L. Steer for their assistance with the field demonstrations and trials, and to Mr. C. P. May for help with the survey of swede injuries in Lancashire. The writer is also grateful to Mr. J. J. Green for his interest in the work and for furthering the investigations.

* * * * * *

AN EAST ANGLIAN DUCK FARM.

THE type of Pekin duck usually to be seen in exhibition pens in this country is distinguished by the light yellow line of the plumage and the bright orange colour of the beak and legs. On an East Anglian duck farm, visited last year by one of the Ministry's inspectors, there is a breeding stock of Pekin ducks which has been imported from America, and from this particular strain the canary colour of the plumage has been entirely bred out, while the beak and legs, although still yellow, are very much lighter than in the old exhibition type.

Compared with the Aylesbury, a breed generally regarded as the standard of perfection for table purposes, the Pekin duck grows rapidly, scaling 6 lb. when about eight weeks old. Although the beak and legs are yellow or orange, the colour of the flesh would seem to compare very favourably with that of the Aylesbury. One of the merits of the Pekin breed is that it lays eggs in quantity, whereas very few eggs are, as a rule, produced in the breeding season by the better known table varieties. At the duck farm under notice, the Pekin breeding pens can be relied upon to supply a large number of hatchable eggs; and the hardiness of the breed makes rearing a comparatively easy task, as the ducklings, when hatched, can be carried through to the killing stage with very little trouble.

The original breeding pen of Pekin ducks from which this particular farm has been stocked shows, in general form, many of the characteristics of the Aylesbury duck, an exception being the pendulous crop which adds a peculiar bulging curve to the breast line of the Aylesbury, thus giving it a weighty and ponderous appearance.

The farm breeding pens have good grass runs, and are well placed on the banks, and within easy reach, of a swift-running stream, an essential arrangement for successful breeding. For hatching, a hot air incubator of 2,000 eggs capacity is employed, and this is housed in a substantial brick building which once formed part of the farm buildings of a general farm. The owner is not altogether satisfied with the incubation arrangements, although, in spite of the severe weather experienced in the early part of the season, the 1929 hatches showed an average of about 70 per cent., which would be deemed very satisfactory on most commercial poultry farms.

When hatched, the ducklings are immediately transferred to a specially-constructed brooder house and placed under hot-water hovers of the Martin-Harvey type. After a short con-

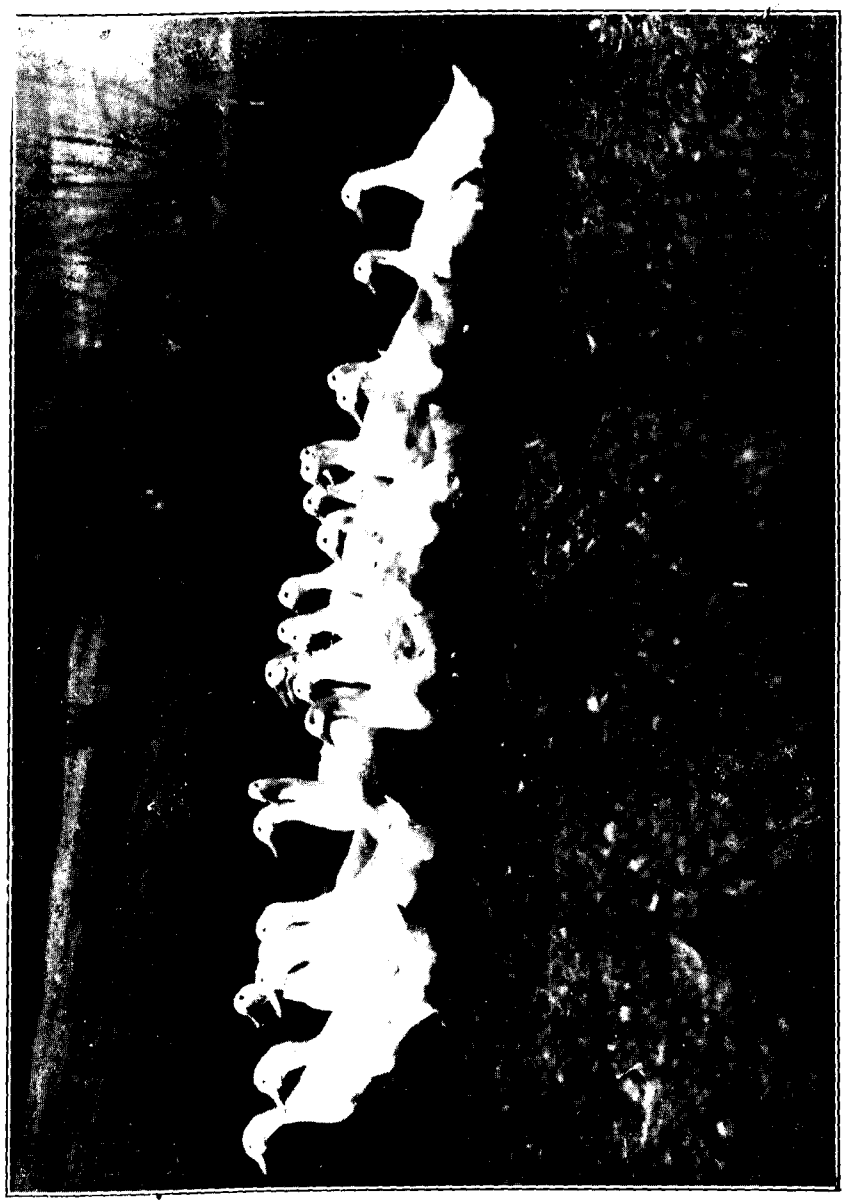

Photo: "Feathered World"

American Pekin Ducks.

A young American Pekin Drake. This bird is pure white in colour, weighs about 11 lb. and has the typical Pekin carriage.

[Photo: "Feathered World."]

finement, lasting about 24 hours, they are allowed to run outside in pens specially partitioned off for each batch. As the young ducks develop, they are passed on through the several compartments that comprise the brooder house, remaining about one week in each. The last compartments hold the birds reaching the killing stage and are not artificially heated. Sandy earth is used on the floors of the brooders, which are cleaned out at regular intervals, the earth being renewed. The grass run to each compartment is, by a careful arrangement of hatches, allowed a short period of rest before being restocked. The land, which is light and sandy in character, is well drained, and the actual paddling of the ducks helps to tighten up this light soil, and, to some extent, improves its moisture-holding capacity. The herbage, which is poor, is also improved in some degree by running the ducks on the land.

The continuous stocking of the runs with ducks does not appear to affect the health of the young birds in any way. Ducks suffer from very few diseases, and, as a general rule, their health gives little cause for anxiety.

Soon after hatching, the ducklings are given a fattening ration which includes white maize meal, barley meal, and semi-solid butter milk. This last ingredient no doubt helps to make the flesh of the Pekin approximate to the whitish character of that of the Aylesbury.

The birds are killed when they reach a weight of about 6 lb., usually attained in about eight weeks from the date of hatching. They are rough-plucked, tied down, and sold in Leadenhall Market. The owner claims to average 1s. profit on every duck marketed, and considers that the prices obtained are good and well above those usually obtained for the ordinary class of duck. They do not, however, exceed the prices given for first-class Aylesbury ducks, which sometimes realize as much as 3d. per lb. more than that given for Pekins.

The Pekin's hardiness, excellence of flesh and rapid growth, together with its ability to produce a large number of hatching eggs, are considered by the owner of this farm to outweigh the disadvantage of the orange colouring of the beak and legs. It is the intention to develop the farm so that it will be capable of producing 6,000 table ducks a year.

[For the accompanying photographs of the Pekin ducks referred to above, which are the property of Captain Roland Hewitt, M.C., Roxhall Farm, Foxhall, Ipswich, the Ministry is indebted to the Editor of *The Feathered World*.]

COUNCIL OF AGRICULTURE FOR ENGLAND

THE Thirty-fifth Meeting of the Council was held on Thursday, February 12, 1931, at the Middlesex Guildhall, Westminster, Mr. Denton Woodhead being in the Chair. The Parliamentary Secretary, Lord De La Warr, and the Permanent Secretary to the Ministry, Sir Charles Howell Thomas, K.C.B., C.M.G., were present.

Agricultural Marketing Bill.—Arising out of the Minutes *Lt.-Col. Sir Merrik Burrell, Bart.* (West Sussex), on behalf of the Chairman of the Standing Committee, Sir Arthur Hazlerigg (unfortunately prevented from attending through ill-health), raised a question as to the changes which had been made in the Marketing Bill since the Council reported upon it at its last Meeting. Sir Merrik said that the Council had given considerable support to the Marketing Bill at that time, but certain changes had been made in the Bill and the Council was now in the position of having given its approval to something which had been altered without its knowledge. He thought it right for the Council to have an opportunity of expressing an opinion on the situation.

Lord De La Warr said that he was glad the point had been raised. There had been a number of minor amendments, many of a drafting character, and there had been one large addition to the Bill, namely, Clause 13, which gave the Minister power to set up what was called a "Re-organization Commission." The reason why it was included was that the schemes which producers would have power to draw up would, in some cases, be of an extremely complicated character and producers ought to have help to do this. The Clause did not alter the voluntary character of the Bill in any way whatever. The Commission would be required to report to the Minister, who would then bring the report to the notice of producers. It put the Minister in the position to offer to the Industry first-class advice from the outside, for them to adopt if they wished.

The Ministry did not consider the Council in any way bound by any resolution to have approved the Clause. It had not been found possible to insert in the Bill any provision as to control of imports, as the Council had suggested, but that did not preclude either this Government or any other Government at a future date from dealing with the problem. As the Bill stood, it did put the producer in a very much better position to compete with the foreigner than he was in at the moment.

As regards other resolutions passed at the last Meeting of the Council, that of Mr. Sampson calling upon the Government and the Leaders of the Opposition to meet together to discuss the question of the ruinous state of Agriculture, and Mr. Cox's resolution to take immediate steps to prevent "dumping," both had been carefully considered, but it had not been found possible for the Government to take action on the lines suggested. As regards Mr. Robinson's resolution concerning insecticides and fungicides—the need for manufacturers to give a declaration of strength—a conference had been called as a result of it, and the Ministry was hopeful that it would be possible to take definite steps before very long. The other resolution on the question of prosecutions under the Fertilizers and Feeding Stuffs Act, 1926, was the subject of a Report to this meeting of the Council from the Standing Committee. *Sir Merrik Burrell* said, with regard to the Agricultural Marketing Bill, that Clause 13 had, in some way or other, created an antagonistic atmosphere to the Bill, and he would like to see this undesirable effect removed. *The Chairman* said that the Standing Committee would watch the Marketing Bill in its later stages on behalf of the Council.

Marketing of Home-Produced Cheese.—*The Chairman*, on behalf of Sir Arthur Hazlerigg, Chairman of the Standing Committee, moved the adoption of the Report on the Marketing of Home-Produced Cheese. In doing so, he said he was quite sure that it would be the wish of the Council to convey to Sir Arthur its deep regret at his inability, through illness, to be present, and its hope for his speedy recovery. He also thought that the Council might wish to congratulate Sir Arthur on his appointment as this year's President of the Royal Agricultural Society. (Hearty assent was expressed.) *The Chairman* then moved the adoption of the report (for text see *Appendix I* to this article, p. 1242). He said, in the course of his remarks, that cheese producers had very little organization from the trading point of view, and that seemed very necessary for them to acquire. The public, too, should be brought to realize that English products ought to have their first attention, even before those from the Dominions. English cheese was the best that could be obtained. We imported, however, 186,000 tons or about three-quarters of our requirements. The home industry should make more cheese, and regain this market, using up more surplus milk, and thus tend to stabilize the milk industry. The Agricultural Marketing Bill should help in organizing the cheese industry.

Mr. Wm. McCracken (Cheshire) complimented the Committee on the admirable Report presented. Producers in Cheshire had been struggling hard to raise the average quality of Cheshire cheese and to market it. Two grades would be put upon the market under the new scheme of co-operative grading. These would be marked with the Federation's mark, and the National Mark when it came to be used would, he thought, rather interfere with the local grade mark, and be detrimental to the local work. He appealed to the Ministry to give close attention to this matter in order to help on what had already been done and was being done. *Mr. H. B. Boden* (Staffs.) thought that grading schemes in the present state of Agriculture were rather putting the cart before the horse. To prepare articles for sale ready for the day when they could be sold was not good. The Report was lacking in that there was nothing in it to encourage the farmer, who always reflected that farm goods were produced under different conditions in this country from those existing abroad, where there was, for example, no control of the producer in respect of wages. *Mr. A. E. Bryant* (Bucks.) said that he was not sure as to the truth of there being over-production of milk. The feeding of a larger number of calves was widely advocated, but in spite of this very large numbers were slaughtered. A large cheese buyer had informed him that he could buy foreign Cheddar which was as good as, if not better than, any English. The poorer people would buy the cheapest cheese every time. *Mr. W. Holmes* called attention to the comparatively high wages paid in Holland, which country, with other farm charges in proportion, could export cheese and beat ours in our own market. The same could, he thought, be said of Canada, New Zealand, and Australia. He was therefore in favour of testing out schemes of organization for the British farmer. He congratulated the Committee on bringing the Report forward. *Mr. W. B. Taylor, M.P.* (Norfolk), said he found himself in general agreement with the Report. On the wider issues of marketing, he was doubtful whether control of imports was practical politics or good business at the present time. In any case, the purpose of the Council should be to help build up step by step on every practical issue that came along, and not to hinder or discourage by reaching out for something that was not practical at the moment.

Mr. W. W. Sampson (Dorset) asked whether, in the comparison of Holland with England, Mr. Holmes could say anything as to regulated hours of labour. There was great difference in a country organizing home production for a home market and a

country organizing for an export market. *The Chairman* ruled a discussion on wages and hours out of order on the present motion.

Mr. Clement Smith (East Suffolk) stressed the point that experts who knew said there was nothing better than cheese from individual farms, carefully and properly made. At the same time, only 25 per cent. of our home-produced cheese could be placed in the first class. There was, therefore, plenty of margin for improvement in 75 per cent. It might be found very difficult to apply the National Mark satisfactorily to cheese, which varied so much in forms of excellence, and while the public taste also varied so much: still he thought the difficulty could be overcome. He had seen cheese made in Holland, and a good part of the butter-fat taken off the milk first. *Mr. R. P. Allsebrook* (Leicester) agreed that there was no cheese like farmhouse cheese, but to-day the women were not so eager to turn out the product from the farms. Cheese-making was hard labour seven days in the week, early and late, and it should be paid better than it is. He thought the only hope was to get it made collectively in farms or factories in the future.

The Chairman then replied to the debate. He pleaded for fair play in competition with imported cheese, which should be sold in our markets only for what it is: given that and the National Mark, English Cheese would hold its own with any cheese in the world. The time might come when fish and chips would be discarded in favour of good English cheese, home brewed ale, and bread made from English wheat.

The Report was then adopted by the Council.

Prosecutions under the Fertilizers and Feeding Stuffs Act 1926.—*Mr. Cecil Robinson* (Holland) moved the adoption of the Report from the Standing Committee (see *Appendix II* to this article, p. 1249). He called attention to the circumstances under which the Report had been prepared, and stated the conclusion of the Committee that it was better to publish the present position widely, and wait to see what occurred within the next twelve months or so. *Mr. J. M. Paine* (Bucks.) objected to the Report; and considered that it should have advocated amendment of the Act. He thought it was against the evidence. *Lord De La Warr* said that, on matters of this sort, the Minister acted as far as possible in agreement with the persons concerned. It was only a few years ago—in 1926—that an agreed measure was introduced, and it would upset that agreement if changes were now proposed. The Minister was quite prepared

to take the action recommended in the last paragraph of the Report and circularize Local Authorities, asking them to redouble their efforts. After a further working period of control, if the Act proved a failure, steps could fairly be taken to amend it.

The Report was then adopted by the Council.

Warble Fly Extermination.—*Sir Merrik Burrell* moved the following resolution :—

> "That the attention of members of the Council be drawn to the Report of the Leathersellers' Company's Warble Fly Committee, a copy of which has been placed before each member. The Council considers (*a*) that all farmers and stock breeders who have dressed their cattle during the Warble season of 1930 should be urged to do so again in 1931 so that the enhanced effect of continuous treatment be observed ; (*b*) that County Agricultural Committees of Counties where no eradication work has hitherto been done should at once take steps to carry out the suggestions of the Warble Fly Committee for experiments and action in clearing out Warbles ; and (*c*) that County Agricultural Committees should, through their officials and in any other ways open to them, do all they can to secure that all other cattle owners should take similar action.
>
> The Council regards the matter as of importance to farmers from several points of view, the chief of which is that the money return for beasts sold for slaughter is likely to be increased as regards both the soundness and quality of the meat, and of the hides, if Warbles be eradicated."

The motion was seconded by *Mr. J. S. Gibbons* (Gloucester). Both mover and seconder informed the Council of their own great interest in the matter, and urged members of the Council to move others in their counties into taking action on the lines suggested in the Leathersellers' Company's Report. Mr. Gibbons stated that the Irish Free State Government were considering the question of taking similar action to that in this country. The Government of Northern Ireland were already taking action. This was a great encouragement to all those in Great Britain who were earnest on this subject. *Mr. H. W. Thomas* (Hants) supported the resolution. Experience in his own county had convinced many farmers of the utility of taking the action suggested. *Mr. R. P. Allsebrook* supported the resolution from the milk farmer's point of view. "Gadding" stopped the milk-flow of cows. He did not think the Warble Fly moved long distances, and if a farmer dressed his cattle, as he himself had done for years, the fly could be eradicated in a comparatively small area provided other cattle were not brought in with the fly in them.

The resolution was put to the Meeting and carried.

Licensing of Bulls.—*The Rt. Hon. Lord Strachie, P.C.* (Somerset), said that, in view of the decision taken by the House of Lords on the previous day in favour of Government control of the licensing of bulls instead of local control, he was prepared for the present to accept that decision, and that he would not move the resolution which had stood on the Agenda in his name. The resolution was accordingly withdrawn.

Agricultural Land (Utilization) Bill.—*Mr. James Donaldson* (Oxford) moved the following resolution :—

> "That the Council of Agriculture for England is of opinion that the Agricultural Land (Utilization) Bill now before Parliament does not afford to the Agricultural Industry the assistance which it now urgently requires, and believes that if the money to carry out its provisions be available it could, with advantage, be utilized for some other purpose more useful to the Industry."

He said that from a practical knowledge of the present dire straits, both of the farmer and the small-holder, and from the fact that there was nothing in the Bill which would ameliorate this position, there was no advantage in the Bill for agriculture. He objected to the Bill first as regards cost, which might run into millions. There was unlimited power to borrow for all expenditure of a capital nature. At an estimated cost per small-holding of £1,100, 125,000 might be created. Then there were allowances for small-holders while being trained. Other large expenses occurred in regard to large-scale farms and demonstration small-holdings, cottage-holdings, and allotments. The success of large-scale farming in the United States and Canada rested upon the price of wheat : with wheat at 60 cents a bushel, much of it would have to be given up. The experiment had been tried also in this country under Government control and had proved a failure. As regards small-holdings, Mr. Donaldson said that to put an unemployed man on the land to-day and do everything for him would put him in the most favourable competition with existing small-holders, many of whom had lost most of their capital and were living in little short of slavery. This anomaly would make the position of County Councils impossible. If, therefore, money for the purposes of the Land Bill could be found, it could, he thought, be put to much better use. First of all, he would say stop "dumping", and then stabilize your price.

The motion was seconded by *Brig.-Gen. H. Clifton Brown, M.P.* (West Sussex), who said that he could not see how the Bill could help agriculture. The compulsory taking of land for the purposes of the Bill would destroy confidence, which at

the present moment was needed more than anything else. The Bill was certain to increase administrative and technical staffs. The whole Bill was a blank cheque and a leap in the dark. In the Report of the International Labour Office, at Geneva, dealing with mechanized farming and labour, it was stated that in Canada the combine harvester-thresher operated by 2 men cuts and threshes 40 acres of grain a day; a farm which formerly took 30 men in spring and another 120 to 150 during harvest, now employed only 14 men throughout the year. Large-scale farming was, therefore, not likely to help employment. The anomaly between the two sorts of small-holders, the new under the Bill and the old under previous Acts, ought certainly to be dealt with before the Bill was further considered. *Mr. W. B. Taylor, M.P.*, said that whilst admitting that the Bill was not, nor had it ever pretended to be, aimed at removing existing difficulties in agriculture, it did aim at relieving unemployment. In the last few years 100,000 men had disappeared from the soil, and there were over 2,000,000 unemployed men in the towns. He thought it was essential that the Government should find employment for suitable men on suitable land. As regards large-scale farming, that did not touch unemployment seriously, though it was true that one type of large-scale farming might reduce labour on a rationalized system. *Sir Merrik Burrell*, on behalf of the Standing Committee, explained that the Committee had never looked upon this Bill as an agricultural one. It was rather envisaged as a Bill to relieve unemployment. It might better have been brought in by the Minister of Labour. *Mr. Alexander Goddard* said that the setting up of an Agricultural Land Corporation to undertake farming on a wide scale was an experiment which might be justified if the country were enjoying full prosperity, but certainly was not justified at a time when every item of expenditure should be scrutinized to see if it is productive or not. The second proposal to acquire land for reconditioning and for demonstration farms was also beside the main issue in to-day's circumstances. As regards small-holdings, the cost of which he put at £1,500 per holding, that proposal put the cart before the horse when the man did not know how to make a living out of a small-holding.

Sir George Edwards said that the workers had never received the Bill with open arms. He thought it was unlikely to alleviate unemployment or to increase the number of men employed on the land. The Government, instead, should bring in an Unemployment Insurance Bill; that would help

the worker and agriculture. *Lt.-Col. G. J. Acland-Troyte, C.M.G., D.S.O., M.P.* (Devon), supported the resolution, as also did *Mr. R. G. Patterson, O.B.E.* (Staffs.), and *Mr. W. Holmes*, who said he would not have taken much exception to the Bill if, first of all, there had been some protection given to the agricultural workers in the shape of unemployment insurance. *Mr. G. E. Hewitt* and *Mr. J. C. Buttle* also supported the resolution, and *Mr. Haman Porter* agreed, saying that as a small-holder he had worked 200 days last year for no financial return at all. *Mr. John Beard* said he would not vote for the resolution, as the Bill aimed at making better use of the land than is being made of it at the present time. He would rather see men try to understand a new occupation than see the very soul go out of them in going to the Labour Exchange day after day without result. *Mr. Bryant* and others also spoke upon the motion.

Lord De La Warr, replying on behalf of the Minister, said that he did not propose to deal with the rather more political sides of the question that had been raised. The disagreement that was felt about this Bill was going to make it more difficult to pass, and was regretted, though as the Government had begun upon it, being convinced that it was the right policy, they would take full responsibility and stand by it. Agriculture had a contribution to make to the solution of the unemployment problem, and it was to supply the unused land, or to equip and improve under-cultivated land in this particular effort. Large-scale farming had a contribution to make; there were considerable arable areas in which the present system of agriculture had broken down and it was necessary to discover how that land could best continue production before the Government could embark on a policy with regard to it. It was impossible to prophesy how this experiment would go. The Government intended that a public Corporation of chosen men should be set up to run it. As regards small-holdings it was surely better to give work than to give maintenance. The Bill was a genuine attempt to provide work. Since the War, including the immediate post-war settlement, when men often suffering from shell-shock and other causes were settled on the land, and in spite of the last two years of agricultural depression, only 15 per cent. of settlers had failed to make good as small-holders. It was, moreover, the small farm that had been just able to hang on during the last few bad years. It might not be the most efficient form of cultivation, but the small-holding had the power of

lasting. As regards cost, Mr. Donaldson had suggested that 125,000 men would be settled. It was impossible to say how many would be settled. It was not known how many were going to apply and how many of those would be suitable. Common sense would dictate the course to be steered as the business went along, and the Government meant to put its back into the work of settlement. The Ministry believed that, given suitable men and the best equipment, it was possible to make a real contribution not only to the men's own prosperity but to the social and national economy of the country. In the course of a short reply to the debate, *Mr. Donaldson* said that the accounts for the Bill would be debited against the Ministry of Agriculture by the Treasury, and, therefore, it had to be looked upon as an agricultural Bill. The expenditure, however, would, he repeated, be of no benefit to agriculture.

The resolution was put to the Meeting and carried without a count being taken.

The Meeting then adjourned.

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APPENDIX I

REPORT FROM THE STANDING COMMITTEE ON THE MARKETING OF HOME-PRODUCED CHEESE

(1) The Standing Committee, in carrying out the work entrusted to it by the Council, to inquire and report with a view to recommendations for improving the marketing of various home-produced commodities, begs leave to present to the Council its Report on the Marketing of Home-Produced Cheese.

(2) In June, 1928, the Committee presented a Report on the Marketing of Milk, and in May of last year two reports were presented on other aspects of the milk industry as they affected the producer. In the Report of June, 1928, the serious factor in the marketing of milk caused by the existence at certain times of the year of large supplies surplus to ordinary market requirements was brought clearly to light. The question of cheese- (and butter-) making is necessarily bound up with this problem of surplus. The milk-producing industry can never regard itself as properly organized for marketing purposes whilst it allows, on the one hand, an abundance of surplus milk to be sold to distributors at a price below the cost of production, thus injuring the ordinary milk market, and, on the other, leaves undeveloped its resources to meet the large home demand for cheese (and butter).

(3) It seems that, in common prudence, a definite minimum quantity of milk should be set aside annually for the making of dairy products, and that means should be found to enable a larger quantity to be so dealt with as it occurs as surplus milk without the organization being overstrained. In other words, it should be arranged by the cheese- and butter-making interests and those of any other sub-industry utilizing milk that they can between them expand their output to the limit of any ordinary surplus of milk and so be able to take the strain from the fresh milk market. This can only be done by organized

producers, acting for the industry as a whole, taking stock of the milk situation and mobilizing their resources in the most efficient manner possible. Obviously, some price adjustment would have to be made for farmers who supply their milk for cheese- (and butter-) making instead of putting it into the retail fresh milk market. This would follow as part of a comprehensive scheme whose main object would be, while using all milk to the best advantage, to get the best price for associated farmers. Under such a scheme, milk producers would, broadly speaking, be paid at the same rate for all milk sold irrespective of the use to which it was put. The weakness of the present unorganized position both from the milk and cheese producers' point of view is illustrated by the fact that during the past 20 years or more, much cheese- (and butter-) making plant, and knowledge, have been scrapped in times of satisfactory fresh milk prices.

(4) The Committee makes this general statement so that the Council may have in mind a true picture of the background of the milk marketing position. Other general arguments in favour of the development and extension of the cheese-making industry in the country are (1) that the best English cheese has a quality and a flavour which are unsurpassed; (2) that there is plenty of home demand for cheese, because, though we produce the best, three-quarters of our requirements are imported; and (3) that the National Mark scheme, which can be applied to cheese, offers an opportunity to the industry which it has never before had, viz., to grade and mark its produce so that it can be sold on its merits and not confused in the mind of the consumer with any variety of imported cheese. This last factor should do much to encourage the production of the best cheese in larger quantities than at present. At present, there is not nearly enough of the best of either of the leading varieties—Cheshire or Cheddar—to satisfy the home demand for the best. Representatives of both industries have informed the Committee that there is never any difficulty in selling admittedly first-class cheeses, though these, we gathered, would not amount to more than about 25 per cent. of the whole supply. We see no reason why this position should be allowed to continue. The cause of so much second and lower quality cheese is that, generally speaking, the industry has not hitherto been organized so as to bring home to the backward individual his technical shortcomings. Some dairy farmers to-day do not yet appreciate what is meant by "bacteriological cleanliness," and how important it is that all milk for cheese-making, as for other uses, should be bacteriologically clean. Indeed, the last item is so important that it operates in practically every case of poor quality cheese. Undesirable bacteria develop in the cheese through being present, as a rule, in the original milk. The Committee has no hesitation in saying, after the most careful inquiry it could make, that the use of clean milk, free from contaminating bacteria, is the chief desideratum in cheese-making. The processes of manufacture must also be guarded against the introduction of infection. After that, good cheese-making is a matter of method. Some differences, mostly in the texture and flavour of the finished product, will always arise through differences in the soil, the pastures, the cows, or their feeding, methods of making cheese, conditions of ripening, etc., and cheese will always be more difficult to make well on some farms than on others, but these differences will not usually prevent the cheese from being of good quality provided it is made from milk which has been produced in a really clean way under clean conditions.

(5) From this statement, it follows that the Committee regards dairy education by teachers acquainted with scientific methods—education of the type which the County Councils, County Agricultural

Committees, and their officers usually offer—can be of enormous assistance in getting into the first class a larger proportion than at present of the cheese produced in this country. It may, in the future, be found good policy to go further and encourage dairy farmers who do not at present make cheese to do so, and so provide themselves with an alternative market to that in which they sell their fresh milk, thus making their industry economically stable and leading to a direct addition to the wealth of the country. The Committee, therefore, has pleasure in paying a tribute to the work which county dairying teachers are at present doing, and urges an extension of the type of education which emphasizes the necessity for clean milk. The holding of Clean Milk Competitions among dairy farmers has been found specially useful in certain counties.

(6) Now to consider the actual question of the marketing of such cheese as is produced. The Report of the Ministry of Agriculture's Markets Division on the "Marketing of Cheese," which was issued only last year, gives a lengthy and thorough survey of the position. It deals with the various types and varieties of cheese made in this country, their supplies and prices, the cheese-making areas, and the development of factory cheese-making. It includes an account of cheese-grading, so far as it is done in this country and in the Dominions and elsewhere, and discusses wholesale marketing, distribution to the retailer, and the question of storage where the cheese is not to be sold immediately. With the general trend of the Ministry's recommendations for improvement the Committee heartily agrees, though it proposes in this Report to restate the case in its own way in summarized form and make its own recommendations.

(7) The annual consumption of cheese in Great Britain is estimated at 186,000 tons, of which less than one-quarter, including both farm and factory-made cheese, is home-produced. Of imported supplies, New Zealand and Canada furnish between 80 and 90 per cent., all factory-made cheese. The leading home-produced varieties are Cheshire and Cheddar, then Lancashire, Caerphilly, Stilton, Leicester, Derby, Wensleydale, and certain others. The quantity of Cheshire cheese produced in this country is stated to be as much or more than all the other cheeses put together. Cheddar is the next largest production, the other varieties coming along with much smaller quantities. The average consumption of cheese per head in Great Britain is estimated at 9½ lb. per annum—a relatively small amount considering the food value, palatability, and cheapness of this food. It is noteworthy that supplies of cheese from New Zealand and Canada dovetail, the bulk of the one coming into the country the first half of the year, that of the other in the second half.

(8) Broadly speaking, cheese may be put into three classes according to the moisture content—*i.e.*, hard-pressed, lightly-pressed, and soft cheese—and usually their length of "useful life" depends upon the same factor; a soft cheese will get mature and go off quickly, a hard-pressed cheese will mature slowly and remain sound a long time. The different kinds will now be dealt with in order of importance in the next succeeding paragraphs.

(9) To take Cheshire first; Cheshire includes three kinds—early ripening, medium-ripening, and late-ripening. The early-ripening cheese is made in the spring and sold for consumption within a month or two. The two other kinds are made later, usually for particular markets according to their special requirements, the North requiring a mild, softer cheese, the South, generally speaking, one which is well-matured. The best cheese, because of the richer quality milk then produced, is made in the autumn, and this is mostly sold and consumed within the next nine months. Stocks of

mature cheese become depleted in the spring, and then, and thereafter, command top prices. Some Cheshire cheese is factory-made, though most of it and the best is made on individual farms and sold to factors or direct to large retail shops. Fairs are held, at intervals of three weeks, in about half a dozen centres and the produce "pitched," which does not always include the best, is sold to factors attending them. A grading scheme under the aegis of the Cheshire Cheese Federation—a producers' association—is in operation and is used at present for about 5 per cent. of the cheese only. This cheese, graded by the Federation's own grader, secures a somewhat higher price than ordinary ungraded cheese, though, through lack of the Federation's strength as a bargaining power, it does not appear always to fetch the full price which its quality justifies. Members of the Federation have the advantage of the expert advice of the grader, and their produce is subject to close scrutiny at almost every stage of its production. This tends to improve the quality still further. In any case, its reliable grading gives it a better standing, and under fair market conditions that alone should mean a better money return for the article.

(10) The bulk of Cheshire cheese, however, is bought ungraded, either direct from the maker's premises or at the fairs. It is usually then transferred to the factor's warehouse where it is conditioned, the factor bearing the loss through diminution in weight and any waste incurred in ripening. He allows for this, no doubt, in the price he pays to the farmer, but his service is one of considerable importance to the industry, and suits the farmer, who has usually no adequate storage for a large quantity of cheese, or, if he has, is not in a position to market it at the right moment of fitness, and in the best market for it, as is the factor. Information as to local market requirements such as colour, texture, and maturity is part of the factor's "stock-in-trade," as is also his ability to judge values in the varieties of cheese he sells. The present division of functions between the maker and the factor—in the Cheshire cheese-making industry at any rate—seems to work fairly well.

If, however, Cheshire cheese producers, or those of any other variety, decide to combine to a greater degree than at present, their organization might usefully take over a somewhat larger part of the work than they do now. In the case of the Cheshire producers, they might not only guarantee members' cheeses as being made from full cream milk of the highest quality, but store cheese in the earlier stages, and grade it at the point where they sell it to the factor. This suggestion represents an advance beyond the Ministry's grading proposal, which is that the cheese should be sold, when new, to the factors, who should be empowered, in the absence of any suitable organization on the producers' side, to carry out the grading.

In addition, they could, with the help of the factors' organization, carry out general publicity work for popularizing Cheshire cheese, both in this country and abroad. An alternative to co-operative action on these lines would be for the producers' organizations to come to an arrangement with existing factors to sell their cheese for them on commission, as is done in a few instances in Cheshire already. On the whole, however, we are not disposed to recommend this as a sound course of action. It would be liable not to get the best value for the Cheshire cheese industry out of the selling activities of the factors.

(11) What we would recommend for improving the marketing of Cheshire cheese, then, is combination of producers, the storage of their cheese up to the point of grading and sale thereafter to factors, both producers and factors joining together for the purpose of efficient advertising and supplying the larger market thus produced

(12) An abuse of fair trading, which we are informed goes on to some extent in the retail markets in which Cheshire cheese is sold, especially during the winter, is the sale of half-meat Dutch cheese as Cheshire. Notwithstanding precautions which are taken by Dutch exporters to mark this product clearly as half-meat cheese, it is said to be sometimes sold as Cheshire. These deceptions, of course, must be stopped. The existing law is against them, but apparently cannot be relied upon to be carried out in the face of great determination on the part of any one of the distributors to misrepresent the goods. It is suggested that one effective way to help the law in this respect is by applying the National Mark to all standard home-produced Cheshire, and urging all shoppers to insist on seeing the Mark on the actual cheese from which they have seen their purchase cut.

(13) As regards Cheddar cheese, the marketing position is much the same as with Cheshire, and the general comments made in regard to that variety apply to it as well. September Canadian Cheddar is also said to be sold all over the country as English, when the market for best Cheddar is ill-supplied. The law against which this is a direct offence should be more rigidly enforced. There is a producers' grading federation, known as the English Cheddar Cheese-makers' Federation, which, however, has been less successful so far, even, than that in Cheshire. The cheese-factors play a similar part in the sale of this usually longer ripening commodity, which requires, on the whole, as much and sometimes even greater care and skill than does Cheshire in its proper storage and conditioning. As the making of Cheddar can be more easily reduced to rules than that of any other chief variety, it is called upon to withstand greater competition from overseas. It is the variety mainly imported. But there is never any difficulty in selling the best home Cheddar, and the aim of Cheddar cheese producers, therefore, is to grade up their output so as to place more of it at the top of the market. There is always room for the best, and the price is invariably good. Here, again, co-operation of producers, followed by a grading scheme in the hands of associated producers after storage and ripening in their own storehouse, are recommended to give the best return to the producer. The cheese-factor should play a very important part at the selling end of any such improved organization of producers.

(14) We have dealt at some length with the Cheshire and Cheddar cheese industry, and will pass the others over with a few brief words indicating any special features. It may be said that they all appear to require the same kind of effort by the producers themselves to make their marketing more successful. *Stilton* is made in two varieties —the white (or "green") kind early in the year mainly for the Midland and Northern market, and the matured kind, *i.e.*, the best-known Stilton, for the end-of-the-year market. The industry is one which is full of possibilities. Its cheeses are the most prized and valued of any in this country—perhaps in the world.

There is already a fair measure of co-operation amongst the Leicestershire and district producers of it, but they sell direct to wholesalers and in competition with each other, group with group. That position cries aloud for remedy. Then there is an insufficient market for the early white Stilton, which we are informed can be sold retail at about 1*s*. per lb. at present, as against the price of 2*s*. and more for matured *Stilton*. *Derby*, *Leicester*, and *Gloucester* are the names of three other cheeses—all hard-pressed—which are mostly only locally known. *Caerphilly* is small uncoloured cheese, with a soft, springy texture and a mild flavour. It is a favourite in South Wales, and is made largely in Somerset. It is easy of manufacture and can be made throughout the year. It is, moreover, economical in that there is a high yield of cheese in it to milk used—1¼ lb. to 1 gallon of milk—and being a lightly-pressed cheese which needs no storage to make it mature, it is sold at once with a minimum of trouble and anxiety to the maker. It also turns the farmer's money over quickly for him. There are weekly auctions of Caerphilly at Highbridge in Somerset, and the prices given there govern those paid on the farms. *Wensleydale* is like Stilton in most respects, though it is lightly pressed and is bandaged during ripening. Another variety, comparable with "White Stilton," is usually consumed in a fairly fresh condition at about six or eight weeks old. *Lancashire* cheese is similar to Cheshire, but coarser in texture and famed for being the best toasting cheese, melting down into a smooth substance of rich and appetizing appearance. *Dorset Blue* is a special variety of skimmed milk cheese, which is prized for its flavour when the cheese is fully ripe; at present, it appears to have no more than a local appeal. The *Cambridge* (or York) cheese made in the Isle of Ely is a soft cheese sold in flat layers of about 1 lb. weight for consumption within a few days of manufacture. *Colwick* is a similar cheese made in parts of the counties of Nottingham and Leicester, while *Cream* cheese is made all over the country for consumption within from two to ten days of making.

(15) In addition to this list, there may be other varieties of local manufacture, and there are the "processed" cheeses which are made of ordinary cheeses, ground up and emulsified, of the varieties which lend them their names. These latter are moulded in tin foil wrapping whilst hot and fluid and are sold in their tin foil segments in small boxes. They are much in demand, though they cannot be said to compare in food value for money with any of the ordinary brands of English bulk cheese. They are simply useful in taking off the market the bulk cheese used in their manufacture.

(16) Despite the fact that the best Cheshire and Cheddar cheeses are made on individual farms, there is a growing movement in favour of cheese-making in factories, or, what is sometimes much the same thing, in a central farm which specializes in cheese-making and is supplied by neighbours with milk on contract. The commonly accepted reason why factory cheese is not up to the good standard of farm cheese is that it is made of mixed milkings, some good, some poor, some old, some new. If that is true, the remedy is not far to seek. Better business methods, including payment to the farmer for quality of milk on a butter-fat basis, should completely alter the outlook. It is unfair that the present usual method of payment by factories for milk should continue—no more being paid for one kind than for another. But such anomalies would, it is opined, quickly disappear when milk and cheese producers get together to work out sound schemes of making and marketing their product. The need to do this is seen to be urgent when cheese producers are reminded that the percentage of their total output which is of superlative quality is not great, and that the remainder has to compete with well-made, well-graded, full-milk factory cheese from overseas. No cheese of less than 50 per cent. fat in the moisture-free substance of cheese is allowed to be exported from New Zealand or Australia, whilst the minimum for Canadian exported cheese is 45 per cent. It is calculated that to give a 50 per cent. fat in cheese a 3⅓ per cent. of butter-fat in milk is required, so that farmers will see that there is no margin for skimming any cream off their cheese-milk. Indeed, it is most important in nearly all varieties that full-cream milk should be used, and we would suggest that a guarantee that it *is* used forms the basis of any properly regulated grading scheme. In New Zealand, payment for milk at the cheese factory on a butter-fat basis has had the effect of raising the

percentage of butter-fat in the raw material so that the fat content of the cheese made from such milk is higher than the market requires. The factories there are allowed to adjust the matter by withdrawing some fat to bring exceptional milk down to average. We do not recommend any such action in this country. Here, uniformity is not so much required as it is in the case of imported brands. It is high quality that is needed. The case for special prices for the best home cheeses depends upon their individual merits, and they may, and should, vary —but they should fall within the prescribed grade qualities, and their contents, so far as butter-fat is concerned, should be guaranteed. Under the present order of things, English Cheddar and Cheshire easily lead the market, sometimes by 30s. and more per cwt., so that the quality is there and is recognised. What is wanted in the interests of the industry is more of the best cheese.

(17) Taking a general view of the whole industry, it appears, in the first place, that there is a compelling need for securing development of cheese-making of all the varieties which have become established in this country. The more home-produced cheese that can be made and marketed, the less will the milk industry be threatened with surplus milk and the more the country will be contributing to its own food supply. Cheese is a very good all-round food, and taken in a varied diet is palatable and satisfying. The steps most immediately required are the organization of producers of each considerable variety of cheese for (1) all-round better methods of production, and (2) all-round improved methods of marketing. As to the best means of obtaining (2), the immediate institution of a National Mark scheme for cheese, each variety being graded according to a plan agreed with each group of producers and distributors, appears to be the best procedure. The grading of the cheeses should be done by experts towards the end of the storage period. A casein disc, as recommended in the Ministry of Agriculture's scheme, should be placed in the rind of each cheese on its manufacture, and this should guarantee that the cheese is made of whole-milk. Where a cheese develops badly in store, or does not ripen properly, and is, therefore, unfit for the Mark, the casein disc, which has become worthless from the point of view of the scheme, should be overstamped so as not to mislead persons uninformed of the details of the scheme into thinking that the disc gives any other guarantee than that the cheese was made of whole milk.

(18) We would suggest that steps be taken, in the first place, with two or three varieties only, possibly, Cheshire, Cheddar, and Stilton. The facilities proposed under the Agricultural Marketing Bill now before Parliament should assist producers to organize on the lines suggested.

(19) When formed for this purpose, producers' associations or boards would no doubt make it one of their earliest duties to ascertain what the large market in the big industrial towns really wants from them; whether it is a large cheese, or one just large enough to see the average small grocer through his usual week-end custom without the need for much "refacing" of the cheese and cutting to waste. In this connexion, it has been put to us by a prominent member of the retailing business that the best weight for an English Cheddar or Cheshire is from 50 to 60 lb. Most are now made at 80 lb. or upwards; that is a good weight for imported cheese which, being cheaper, usually sells quicker. What the larger distributors want is to be in a position to buy 100, 200, or 500 Cheddar cheeses, all of similar sizes and stated qualities. This they could do from the storage depots of organized producers in the same way as the cheese-factor would buy from such

depots. The number of shops now selling English Cheshire or Cheddar is comparatively small, and there is a large market awaiting keen business endeavour as soon as a National Mark scheme is set on foot, and gives its guarantee to the retailer and the public.

(20) For convenience of reference, the main conclusions of the Committee are summarized as follows:—

(a) That the dairy industry should become fully organized so that the cheese section of it can be supplied with milk at a fair price to enable it profitably to make cheese of the various kinds for which a market exists.

(b) That each group of cheese-makers should concentrate on making the best quality cheese of its particular variety, and that for this purpose special attention should be paid to the production of milk which is bacteriologically clean.

(c) That to assist in (b), the County Authorities should extend their scientific dairy education in the Counties and the holding of Clean Milk Competitions.

(d) That cheese producers' associations in the case of those varieties requiring storage and selected for marking with the National Mark should retain their cheese in their own stores until it approaches maturity, when it can be marked with the National Mark. At this point, the factors would normally take control of the selling and do whatever is possible to improve the marketing.

(e) In order to prevent mistakes and fraud, purchasers of cheese should, in buying home-produced, or (later) National Mark cheese, see that the cheese they buy is cut from the block or round of cheese marked with the corresponding label. The law prohibiting the sale of imported Cheddar, or Cheshire, or any other place-named variety of British cheese without a label indicating that it is imported Cheshire, Cheddar, etc., should be more strictly enforced.

(f) That in view of the desirability of assisting the sale of early white Stilton (locally called "green"), the fact that it may be purchased in the early summer at about 1s. a lb. retail should be widely advertised.

(g) That the public be advised that, as a rule, the quality of cheese depends upon fat content, which, again, depends upon the butter-fat in the milk used. Much imported cheese is poorer in fat content than home-produced, and if the National Mark scheme proposed by the Ministry of Agriculture is adopted in its present main features, National Mark Graded cheese will be the certain product of this country and will be made only from Whole Milk.

February 2, 1931.

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APPENDIX II

REPORT FROM THE STANDING COMMITTEE ON THE QUESTION OF PROSECUTIONS UNDER THE FERTILIZERS AND FEEDING STUFFS ACT, 1926

(1) The question of the effectiveness of the requirements of the Fertilizers and Feeding Stuffs Act, 1926, in regard to the institution of proceedings against merchants who supply farmers with feeding stuffs which are not up to the guarantee was raised in a resolution at the last Meeting of the Council. The suggestion in the resolution

was that the present provisions of the law, whereby action in the Civil Courts is prescribed, should be replaced by power to Local Authorities to institute criminal proceedings in respect of defective samples taken on the premises of the purchaser. The resolution was not carried, the voting for and against being equal. The Standing Committee, on that result, considered that, in view of the body of opinion on the Council in favour of a reversal of the form of the law, there must exist, either apprehensions which are justified and should be met by changes in legislation, or misapprehensions which should be cleared away. It, therefore, examined the whole question as far as it was able, and now presents the following Report.

(2) It appears that one of the chief conclusions of the Departmental Committee on Fertilizers and Feeding Stuffs Legislation, which reported in 1924, was that criminal proceedings should no longer be instituted in respect of samples taken on the farm, but only in respect of samples taken on the premises of the seller. The object was not only to remove any risk of unfairness to the trader but to meet the farmer's objection to being drawn into criminal proceedings in respect of samples taken on his farm. It was thought by that Committee that the farmer's objection in this connexion had the effect of making the legislation less effective than it should be for its purpose. That Committee were unanimous in their view that there should in future be no prosecutions, but only civil proceedings, in respect of samples taken on the farm.

(3) The position then is that where a sample taken on a farm proves to be unsatisfactory, the seller cannot be prosecuted in respect of that sample, although the purchaser can claim for damages—in the Civil Courts if necessary—after the proper marshalling of his evidence, which should include a certificate of analysis by the Local Authority's officer appointed to issue such. It is, however, practicable for the officer of the Local Authority, finding an unsatisfactory sample on a farm, to communicate with the inspector for the district from which the goods came, and so enable a prosecution to be taken in hand by drawing a similar sample on the premises of the really responsible party. This procedure represents an advance on that of the earlier Fertilizers and Feeding Stuffs Act (of 1906) in which it was frequently found that the man whom the law required should be prosecuted was an intermediate seller who was not morally responsible for the misdescription.

(4) It has been represented that the new provisions fail in effectiveness because of the need for Local Authority inspectors to trace a given parcel of goods from the farm through two or three, or more, middlemen to the manufacturer, who, by the time the last inspector arrives at his factory, has no more of the article in question and cannot, therefore, contribute the evidence on which he could be prosecuted. It is stated also that because of the form of the law—the onus for action in the case of "farm" samples resting with the purchaser who must get redress by civil means—no action is taken; the purchaser does not care to take the trouble.

(5) The Committee has considered the whole position, and has come to the conclusion that, as suggested by Sir Charles Howell Thomas at the last Meeting of the Council of Agriculture, the Act of 1926 should be given a further trial. In the first place, criminal proceedings do not depend on samples being first taken on the farm. There are a number of Local Authorities which are regularly sampling on the premises of sellers, as a matter of routine, in order to test the accuracy of the descriptions applied to the goods sent out. In the second place, the fact that comparatively few proceedings, either civil from samples taken on the farm, or criminal from samples taken

on the manufacturer's premises, have been instituted, may largely be due to an insufficient realization of the true position by farmers and their advisers, though doubtless many civil cases are settled out of Court. If, however, farmers would exercise their right under the Act to call upon the Local Authorities' officers more frequently to take samples and have them analysed officially as laid down in the Act, then the farmer would be more frequently put in a position to claim for any shortage from the manufacturer. Local Authorities charge, usually, a very small fee for this service, which covers the taking of samples of ordinary fertilizers or of concentrated feeding stuffs and analysing them. On the showing of the certificate which the farmer obtains, he can base his claim on the manufacturer, or the person responsible for stating the analysis which is proved to be wrong.

(6) It does not seem to the Committee that the farmer need fear to incur odium, or disadvantage of any kind, through standing up for his rights as a buyer, on production of clear evidence of error on the part of the supplier. It is always understood that in serious cases the Local Authorities' inspectors can make a point of discovering and prosecuting a fraudulent manufacturer or merchant, but in ordinary instances where the shortage may be due to minor discrepancies which the manufacturer or merchant would quickly put right if he knew about them, it seems that a straight and simple request from the farmer for reimbursement, backed by the Local Authority's certificate, is the best way to meet such cases. There seems to us no question that if farmers widely use the provisions of the Act of 1926, suppliers would become very careful to see that their goods came up to sample before sending them out.

(7) We, therefore, recommend that the fullest possible publicity be given to the provisions of the existing laws, and the measure of protection which they give to farmers, and that farmers be recommended widely to use them.

January 22, 1931.

MARCH ON THE FARM

WILLIAM LAWSON, M.B.E., N.D.A., N.D.D.,
Director of Agriculture for West Sussex.

Arable Land.—An early decision must be made as to what crops, if any, are to be grown on the fallow or root area. It is possible that the area under sugar beet may be somewhat reduced, though we must hope not; there is great difficulty in deciding which crop should take its place. Sugar beet has the merit of being at the same time a cleaning crop, a source of food for live stock and a direct cash crop. No other crop can take its place in all these particulars.

Potatoes are a cash crop, but in years of heavy yields the producers may be faced with low prices. Most of the other crops suited to the fallow year of the rotation have to be cashed through live stock, and their value is difficult to assess. The actual cost of growing the fallow crop cannot be accurately determined. On a strict economic basis the costs are considerable, but a very large amount of the expenditure included is on account of work done by the regular staff of whole-time farm workers and horse teams or tractors. Much of this expenditure may be unavoidable in any case, and if the fallow crop is eliminated we must inquire whether the horse teams and men can be employed on other work, and would that other work be remunerative. Farmers must answer these questions for themselves, having regard to their individual circumstances, and then assess the cost of the fallow crop. The other side of the account is the value of the fallow crop to the stock farmer, and particularly the large amount of stock food which can be produced per acre.

There is a great variety of crops to select from, and each crop has its individual varieties and strains. Most varieties are well suited to our climate, and there are few countries where root crops can be grown to greater advantage. Crops of one or more types may be grown according to circumstances. Mangolds are a great favourite in the south and Midlands, but, farther north, swedes and turnips are predominant. Green crops like cabbages, marrow-stem kale, thousand-headed kale, rape and rape kale are increasing, and are valuable sources of green food available during winter when the need is great. The value of green food in winter is being increasingly appreciated, as the needs of the animals are better understood.

As long as there is arable land, and as long as live stock

are a feature of farming, the growing of green crops and roots for winter consumption has attractions and advantages. It is not inconceivable that in many cases arable land will be maintained to produce such crops, as well as straw, irrespective of the price of grain.

The nature of the soil will determine the extent and the nature of the fallow crop. On heavy soils the bare fallow is still the cheapest and best method of cleaning the land. On the lighter soils some form of cropping is desirable. In typically arable districts working on a four- or five-year rotation the fallow area is greater than is desirable or economical at the present time.

A reduction of the fallow cropping may be effected in several ways. Silage crops are a useful substitute, and a mixture of 40 lb. tares, 40 lb. beans and 80 lb. oats, sown in early spring, will provide a crop for silage in July, or a similar mixture substituting peas for beans can be cut at the same time and made into hay; in either case the crop is removed in time to allow fallowing and cleaning to be done in preparation for winter cereals.

Temporary Pastures.—The adoption of longer rotations and the inclusion of temporary pastures for three or four years is an obvious way of reducing the fallow area. Such a practice means a reduction in cereal cropping and an increase in live stock farming. Temporary pastures have long been a feature of Scottish farming, and though much less common in England, particularly on the eastern side, it seems inevitable that the practice will increase.

The engineer has put at the disposal of the cereal growers in all parts of the world machinery which is specially adapted for large-scale cultivation of cereal crops, and the small cultivator, whose turnover is insufficient to justify the capital expenditure involved, is at a disadvantage. Large farms highly mechanized are dominating cereal production.

In face of these opinions it might be asked why not advise going the whole way and laying the land down to permanent grass? Such a course has its disadvantages. In the first place, live stock require litter to keep them comfortable and clean, and nothing is more attractive to the animal lover in this respect than straw, and there is also the value of the straw in soaking up liquid manure and adding to the value of the farmyard manure. Then there is the question of the winter keep; an all-grass farm produces grass and hay. Grass may be available in good condition for five months

in the year; with good management this may be extended to six months, and in special circumstances may even be useful for seven months, but that is about the limit as far as cattle for milk or beef production are concerned. This leaves a substantial portion of the year to be provided for without green succulent foods. Root crops or winter greens cultivated on arable land add to the stock-carrying capacity of the farm, and to the health and well-being of the stock. Temporary pastures have a further advantage in responding more readily to manurial treatment and in starting into growth earlier than old-established pastures under the same climatic conditions. This earlier growth is an advantage in years of drought, and the production up to midsummer, at any rate, is usually assured after the winter rainfall.

Another advantage of temporary pastures over permanent grass is the opportunity which occurs for utilizing the fertility which accumulates during the life of the pasture, particularly under grazing conditions. In Scotland the introduction of wild white clover seed into the mixtures for short-term pastures has created a new problem, and one of the needs of the moment is a cereal which can be grown immediately after the temporary ley and will not lodge before harvest.

The extension of temporary pastures can be recommended at the present time because of the relative economic position of stock farming as compared with cereal growing, and also because the knowledge and material now available to make them a success are greater than at any other time in the history of agriculture. Wild white clover and leafy strains of grasses will, with correct manurial treatment, overcome many of the drawbacks to temporary pastures that have been experienced in the past.

Warble Fly.—The campaign for the destruction of warbles carried out in Worcestershire in 1928 and 1929, and over a large part of the country in 1930, should leave no doubt in the minds of stock owners as to the efficacy of the means taken to reduce the pest. The loss due to the ravages of the warble fly is very heavy. The loss of milk, meat and thriving condition caused by the running of cattle when the fly is on the wing must be added to the loss through damaged hide and flesh when the animal is slaughtered. The derris-soap wash is generally recommended and treatment should commence before the end of this month.

Full information can be obtained by consulting the reports of the Worcestershire County Council Agricultural Education

Sub-Committee on the Ox Warble Fly, the Report on the Warble Fly Campaign of 1930 issued by the Leathersellers' Company, or a leaflet on The Warble Fly (No. 21) to be obtained gratis on application to the Ministry.

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NOTES ON MANURES

H. V. GARNER, M.A., B.Sc.,
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Bracken Litter.—Inquiries are sometimes received with regard to the relative values of farmyard manure made from bracken as compared with straw. As far as direct experiments are concerned there seems to be very little information available, but some approach to the question can be made on general grounds. The value of a material for litter will depend on three chief factors:—

(1) Its absorptive power for liquids;
(2) Its retentive power for ammonia; and
(3) Its manurial value reckoned on its content of nitrogen, phosphoric acid and potash.

As far as the first item is concerned dry bracken appears to fall below straw, as might be expected from the nature of the material. French figures give the following absorption of liquids per 100 lb. of dry substance:—

Wheat straw, 220; bracken, 145, while German figures are more favourable and give rye straw, 240–265; bracken, 259. Naturally a good deal of variation is to be expected in such estimates.

Bracken is also probably inferior to straw in its retentive power for ammonia, because, as it is more woody, there is less easily decomposable carbohydrate to balance the nitrogen, while its own nitrogen content is higher to start with—*i.e.*, the material is more nearly saturated in respect of nitrogen in any case.

The content of nutrients in the dry matter of plants varies considerably with the state of growth and the degree of washing to which the plant substance has been subjected. Material cut young and dried under cover will be the richest in plant nutrients. Old fibrous material cut and allowed to stand in the open will be the poorest. This is well shown in certain figures from the West of Scotland Agricultural College:—

Date of cutting	*Dry matter* (Per cent.)	*Potash in dry matter* (Per cent.)
May ..	8·0	5·26
July ..	21·5	3·02
October ..	73·9	·77

Bracken is about equal to straw in its phosphoric acid content, but distinctly superior both in nitrogen and potash, although if it is taken when old and much washed the potash may be reduced to about the proportions present in straw. Approximately 95 per cent. of the total potash in bracken is extractable by water.

Some typical analyses are :—

	Nitrogen	*Phosphoric acid*	*Potash*
Bracken	2·5–3	·3	2·3
"	2·4	·45	1·86
"	1·44	·20	·11
Average straw	·55	·22	·99

Manure made with old woody bracken takes a long time to decay in the soil, and hence is probably more suitable for use on compact soils, where the fibre may have physical value, than for the more open types of land.

Interactions of Fertilizers.—There are two types of fertilizer experiments. The most straightforward are those in which comparison is simply made between several alternative forms of the same nutrient. For example, nitrate of soda is compared with sulphate of ammonia and with cyanamide, the manures being used alone or in conjunction with a basal dressing common to all the plots. The comparison of several different rates of application of a fertilizer falls into the same class ; as do also variety trials as ordinarily conducted.

More recently attention has been turned to what is called the interaction of fertilizers. This can be investigated by using the manures not only singly but also in combination. Let us suppose, for example, that plots are put down as follows : (1) No manure, (2) nitrogen only, (3) phosphate only, (4) nitrogen and phosphate together. The effect of nitrogen only can be derived from (1) and (2), of phosphate only from (1) and (3) while the effect of nitrogen and phosphate in combination comes from (1) and (4). If, within the error of the experiment, this last effect is the sum of the two individual effects previously mentioned then there has been no interaction (or at any rate the experiment in question has not been accurate enough to detect it), and we may say that nitrogen has produced the same effect at both levels of phosphate nutrition, and phosphate has produced the same increase at both levels of nitrogen nutrition. Moreover, if this is so, the basis for gauging the effects of nitrogen and phosphate in this experiment has thereby been doubled, for instead of having to regard the phosphate individually we may use (1) and (3) against (2) and (4) to measure the nitrogen effect, and (1) and (2) against (3) and (4) to measure the phosphate effect. The number of plots in the comparison is doubled and the precision of the comparison is increased in the proportion of $1 : \sqrt{2}$ or 1·4 times.

Now quite frequently a definite interaction is revealed in the sense that the combined effect is not the sum of the single constituent effects. It is usually greater ; which means that, as commonly expressed, each fertilizer helps the other out. It sometimes happens that the addition of one fertilizer to another gives significantly less than the effect which might be inferred from their individual action. In any case these interactions when definitely established are real effects which have their bearing on the use of fertilizers in combination, and must be as far as possible interpreted. Further, the arrangement of experiments in such a form as to reveal interactions has the valuable feature that, if an interaction is found, a useful piece of information has been secured, but if no such effect is demonstrated, then the accuracy of the experiment on the other comparisons is increased.

Another common type of interaction occurs when different forms of the same nutrient are used. Thus nitrate of soda and sulphate of ammonia might each be compared in the presence and absence of potash.

(1) Nitrate only, (2) nitrate and potash, (3) sulphate only, (4) sulphate and potash. In such a case it might well be found that the potash effect as measured by (1) and (2) is less than as measured by (3) and (4), when an interaction has occurred and would be expressed by practical men by saying that potash is more necessary when sulphate of ammonia is used than when the form of nitrogen is nitrate of soda.

Clearly the number and variety of interactions is very great. Various interactions with fertilizers have already been demonstrated at Rothamsted in the sense that one variety responds differently from another to the same manurial treatment. Since the magnitude of interactions is usually less than the straightforward manurial effects, experiments of a rather precise nature are necessary to demonstrate them with certainty.

Distribution of Fertilizers.—Much attention is now being devoted to the question of the accurate distribution of fertilizers. This has always been important, but with the definite tendency

towards more concentrated materials which is now making itself felt, and will no doubt continue to be more marked as time goes on, the need for accurate application is still greater. Thus a good grade, complete mixture, made from ordinary constituents, would contain about 5 per cent. of nitrogen, 8 per cent. of phosphoric acid, and 12 per cent. of potash, and the rate of application of such a mixture might vary from 4 cwt. for cereals up to 12 cwt. for potatoes. If the newer high-grade materials of the type now widely used on the Continent were employed to provide the same nutrients as the above, dressings of rather less than one-half of the above would be required. With the smaller dressings there is the possibility of irregular sowing leading to some areas being completely missed, or almost harmful concentrations being applied to others.

Further, there is already the need for the uniform application of small dressings of 1 cwt. of nitrogenous fertilizer to cereals and to grass land, and if more concentrated forms of nitrogen are introduced the claims made on the accuracy of manure distributors will be greater still. Fertilizer distribution on a farm scale is by no means a simple problem. The variation of fertilizers in physical condition is considerable, ranging from distinctly sticky mixtures on the one hand to free-running crystalline powders on the other. Their rate of application may vary from 1 cwt. up to almost 20 cwt. per acre, and uniform distribution is highly desirable. Yet to achieve this it is necessary to have a mechanism which will also stand up to farm usage and work on rough ground. In view of these heavy demands it is not surprising that, in searching tests of fertilizer distributors recently carried out, all the desired points were not discovered in the same machine.

In February, 1930, a trial and demonstration of manure distributors took place at Wye College, when seven different machines representing most of the types in common use were tested. The machines were required to operate as follows :—

(1) On ploughed land to sow a mixture of 4 parts superphosphate, 1 part muriate of potash and 1 part sulphate of ammonia, at the rate of 6 cwt. per acre—this representing a farm-made mixture of slightly sticky character.
(2) On seeds ley to sow 4 cwt. superphosphate, 1 part muriate of potash and 1 part steamed bone flour at 6 cwt. per acre—this being a dry friable mixture.
(3) On grass to distribute cyanamide at 1 cwt. per acre. Photographic records of the spread of the manure on a white surface were obtained for each machine in this test.

As might be expected with so wide a range of designs and working conditions, much information with regard to the

capabilities and limitations of the various types was obtained. These are discussed in a report.*

In April an exhaustive trial of twelve different machines was made at the Experimental Farm of Imperial Chemical Industries at Jealott's Hill (see this JOURNAL, August, 1930, p. 439). The machines were required to apply the following dressings:—

(1) North African phosphate, 6 cwt. per acre.
(2) Complete mixtures, ordinary grade, 3 cwt. per acre.
(3) High-grade mixture, 2 cwt. per acre.
(4) Sulphate of ammonia, 1 cwt. per acre.

A quantitative measure of the distribution along the track of each machine was obtained by weighing the manure caught in a series of trays laid in the line of travel, while the lateral distribution was judged by inspection of exposed surfaces suitably coloured to show up the manure. These patterns were also photographed. Many numerical data were obtained with regard to the capabilities of various classes of machines in handling the above manures, and also on the important question of adjustment to deliver stated quantities.

All this work is to the good and cannot fail to direct the attention of manufacturers to certain points capable of improvements.

Similar work is being vigorously undertaken in the United States, with a view to economy in the use of fertilizers by the better results following correct and accurate methods of application. The special interest there lies in the correct location of the fertilizer salts in relation to the seed of crops grown in wide drills, maize, cotton, and potatoes, the object being to secure the advantage of a high concentration of nutrients in the neighbourhood of the growing plant while avoiding the risk of injury to germination. As in this country, detailed examination of the performance of existing machines has revealed many points in which improvements should be possible.

Although the time of application of manures is receiving some attention in this country, the position of fertilizers in relation to the rows of potatoes, sugar beet and other root crops has not as yet been closely investigated.

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* C. Davies and G. R. B. Smyth: *Demonstrations and Trials of Manure Distributors*, Wye College, 1930.

PRICES OF ARTIFICIAL MANURES

Description	Average prices per ton during week ended February 11				
	Bristol	Hull	L'pool	London	Cost per unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of soda (N. 15½%) .. *	10 0*d*	10 0*d*	10 0*d*	10 0*d*	12 11
Nitro-chalk (N. 15½%) .. *	9 7*d*	9 7*d*	9 7*d*	9 7*d*	12 1
Sulphate of ammonia :— Neutral (N. 20·6%) .. *	9 10*d*	9 10*d*	9 10*d*	9 10*d*	9 3
Calcium cyanamide (N. 20·6%) *	8 16*e*	8 16*e*	8 16*e*	8 16*e*	8 7
Kainit (Pot. 14%) .. .. §	3 8*a*	2 19*a*	2 19*a*	3 3*a*	4 6
Potash salts (Pot. 30%) .. §	5 6*a*	4 18*a*	5 0*a*	4 19*a*	3 4
„ (Pot. 20%) .. §	3 17*a*	3 9*a*	3 8*a*	3 12*a*	3 7
Muriate of potash (Pot. 50%) §	9 17*a*	9 3*a*	9 2*a*	9 5*a*	3 8
Sulphate „ „ (Pot. 48%) §	11 19*a*	11 6*a*	11 5*a*	11 5	4 8
Basic Slag (P.A. 15¾%)‖ .. §	2 13*c*	2 3*c*	..	2 9*c*	3 1
„ (P.A. 14%)‖ .. §	2 7*c*	1 16*c*	1 16*c*	2 3*c*	3 2
„ (P.A. 11%)‖ .. §	..	1 9*c*	1 9*c*	..	..
Ground rock phosphate (P.A. 26-27½%)‖ .. .. .. §	2 10*a*	..	2 9*a*	2 7*a*	1 9
Superphosphate (S.P.A.16%) §	3 11	..	3 9	3 1	3 10
„ (S.P.A.13¾%) §	3 5	2 18	3 3	2 15	4 0
Bone meal (N.3¾%, P.A.20½%) §	8 15	7 10	8 2	6 10	..
Steamed bone flour (N. ¾%, P.A. 27½-29¾%) .. .. §	5 19*b*	5 5*f*	5 15	4 7	..
Burnt Lump Lime .. .. §	1 5*l*	1 2*m*	1 9	1 17*h*	..
Ground Lime .. .. .. §	1 12*l*	1 8*m*	..	1 12*h*	..
„ Limestone .. .. §	1 3*l*	1 6*g*	1 7*k*	..	..
„ Chalk .. .. .. §	..	1 6*g*	..	1 11*h*	..
Slaked Lime .. .. .. §	..	..	2 9	2 17*h*	..

Abbreviations: N.=Nitrogen; P.A.=Phosphoric Acid; S.P.A.=Soluble Phosphoric Acid; Pot.=Potash.

* Prices are for not less than 6-ton lots, for delivery during the month, at purchaser's nearest railway station, unless otherwise stated. Unit values are calculated on carriage paid price.

§ Prices are for not less than 2-ton lots, net cash for prompt delivery f.o.r. in town named, unless otherwise stated. Unit values are calculated on f.o.r. price.

‖ Fineness 85%, through standard sieve.

a Prices for 4-ton lots f.o.r.

b Delivered (within a limited area) at purchaser's nearest railway station.

c Prices for 6-ton lots; at Bristol, f.o.r. Bridgwater; at Hull and Liverpool, f.o.r. neighbouring works, and at London f.o.r. depots in London district.

d For lots of 4 tons and under 6 tons the price is 1s. per ton extra and for lots of 2 tons and under 4 tons 5s. per ton extra.

e Delivered in 4-ton lots at purchaser's nearest railway station.

f Delivered Yorkshire stations.

g F.o.r. Knottingley. Ground limestone 100% through standard sieve.

h Carriage paid 6-ton lots London, bags included.

k In bags, f.o.r. Liverpool. Fineness 45% through standard sieve.

l Carriage paid 6-ton lots Bristol.

m Carriage paid 6-ton lots Knottingley.

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NOTES ON FEEDING STUFFS

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Specific Action of Foods.—The nutritive value of a food is measured by its starch equivalent and digestible protein content; several other properties are recognized, such as its content of minerals and vitamins, and its effect on the rate of digestion, but even with all these it is sometimes felt that we do not take cognizance of all aspects of the food. One very difficult question is that of its specific action for any particular function in the animal body. The point can be made clear by reference to a case quoted to the writer by a correspondent in India who is responsible for the feeding and management of large numbers of cows. One food that he has available is a pea called gram, and he finds that this shows a marked superiority to other foods, such as a mixture of barley and linseed cake; that is to say, an amount of starch equivalent and digestible protein in gram produces better yields than the same amount in other foods. The explanation of this may lie in some vitamin-like substance occurring in small quantities in the gram, but more probably, as the correspondent suggests, in the composition of the protein. It may be that some amino-acid, which is apt to be deficient, figures largely in the protein of gram, and consequently that this food, as it were, pulls more than its own weight; this view is strengthened by the fact that a wider nutritive ratio can be allowed when the ration includes gram than when it does not.

The general experience is that protein has a stimulating effect. It is known to increase the heat production of the animal, and this is referred to as the "specific dynamic action"; all foods exert some influence in this direction, but proteins far outstrip the others. The actual increase of heat production can have little agricultural interest, but it seems to be associated with a raising of the whole metabolism and consequently with an increased production. Several experiments have led to the conclusion that feeding protein well above the requirement to milking cows gives an increased yield, and, in some cases, that the fat percentage is also raised; increasing the starchy and oily foods, on the other hand, has not had the same effect. Nevertheless, some experiments have gone the other way, and, in view of the contradictions that have appeared in trials, it could not be recommended to overfeed in the expensive part of the ration (protein) with the idea of stimulat-

ing yield; any extra production caused in this way involves inefficiency in the conversion of the food to milk, and would be uneconomic. The contradictions have probably arisen because proteins have different "qualities"—that is, some have a composition suitable for providing the materials for building up milk proteins whilst others have not. It would, therefore, be better to try to use the proteins of high quality than to overfeed indiscriminately; here, however, there is little information available for guidance.

In general, the proteins of clover hay, bran and linseed cake are good, whilst those of milk and its products are regarded as perfect. At the other extreme the protein of maize is bad, since it is incomplete and lacking in essential amino-acids, whilst oats, middlings, and cotton-seed are intermediate between the good and bad. Presumably a protein may be good for one purpose though bad for another, but as yet we know few details on this. Barley is good for maintenance and fattening, but bad for growth, and possibly also for milk production; brewer's grains are good for milk, but bad for growth. With milking cows it has been shown that the proteins of wheat are not efficient, and that if the milk yield is at all considerable (3–4 gal. a day) the protein balance cannot be maintained on them; the same remark probably applies to a number of other foods, and, in fact, it has been argued that the low quality of the proteins fed is mainly responsible for the decline in yield as the lactation progresses.

For a number of years, Professor Hansen, of Berlin, has been investigating the specific effects of different foods for milk production, and he gave his general conclusions in a paper read to the World's Dairy Congress in London in 1928. He divided foods into four groups. The first group increased the milk yield, but lowered the fat percentage to about the same extent, so that the total amount of fat produced was unchanged; this group included soya bean meal, ground maize, and ground oats. Another group had no effect on the milk yield, but lowered the fat percentage and consequently also the total weight of fat produced; this group included sesame cake, poppy seed cake, and rice flour. A third group appeared to have no marked effect. His last group had little if any effect on milk yield, but increased the percentage of fat, and hence the total amount of fat produced. These would appear to offer the greatest possibilities, and the two showing the most marked effects were palm kernel and coconut cakes, which raised the yield of fat by 18 and 12 per cent., respectively. Kellner

also found that these two cakes increased the fat yield. This is interesting, as they are residues obtained when pressing out oils for margarine; in other words the fat they contain is as near butterfat as margarine is to butter—and though some may say that this is not very close, it is near enough to allow of a certain amount of deception. It is probable that if a fat is being digested which approximates more or less to butterfat in composition it may be transferred more readily into the milk. This would seem to be the explanation of the benefit derived from feeding these two cakes; this conclusion is strengthened by further figures given by Professor Hansen, who showed that the yield of fat was raised successively as the palm kernel cake fed was increased up to 12 lb. a day, and also that brands of this cake rich in fat (*i.e.*, oil) were more effective than those poor in fat—in other words, that the important ingredient in the food in this case was the fat, and not the protein.

Professor Hansen pointed out that it would be useless to search for these particular actions of foods unless they were being fed in considerable amounts; small quantities can be dealt with normally by the body, whereas large quantities will tend to swing processes over in a certain direction, and so make the body work abnormally, which is after all the continual aim with high-milking cows. The classic case in this connexion is with feeding dogs; it has been shown that if large amounts of an oily fat are given the fat on a dog's body will be made softer, but no effect is found when only small amounts are fed, even over a long period, for the body can then deal with them as they come along, and can convert them into its normal fat. Similarly, if it is required to improve the fat percentage of the milk by feeding palm kernel or coconut cake it is no use feeding an odd pound or two; rather will it be necessary to incorporate them boldly, so that they form a large part of the ration. In this respect it is fortunate that these two cakes are balanced foods, as this means that they can be added freely to a ration without upsetting its nutritive ratio.

A word should perhaps be said about this term "nutritive ratio," for though it has its uses it is beset with pitfalls. It is, essentially, the ratio of the non-protein nutrients in the food to the protein nutrients, and is calculated as

$$\frac{\textit{Digestible Fat} \times 2{\cdot}3 + \textit{Digestible Carbohydrate} + \textit{Digestible Fibre}}{\textit{Digestible Protein}}$$

By this figure foods are readily classified on the basis of their richness in protein; with high protein foods the figure obtained

is a low one and the nutritive ratio is said to be a narrow one, whilst with starchy foods the figure is high and the ratio is said to be wide. In helping to pick out foods it has a definite place, but it is possible to be led seriously astray in calculating the nutritive ratio of a mixture; the only safe way in that case is to tot up the separate nutrients (fat, fibre, etc.) contained in the mixture and work it out afresh, and short cuts may lead to an answer that is very wide of the mark. It should be regarded as a purely descriptive figure, and should not be introduced into the calculations in rationing; in fact, it might well be argued that its advantages are problematical and that it should be dropped altogether—it is really only a "frill" in the science of rationing and can easily be dispensed with, and as a result of experience it is much less used nowadays than formerly.

The particular effects of foods on the animal body and their special influences on its behaviour are difficult to explain. Probably most cases can be met by assigning them to the quality of the proteins and fats contained in them. Other effects may be due to vitamins or minerals, or to physiological effects on the rate or efficiency of digestion: roots may owe much of their special value to factors such as these. In the aggregate, farmers spend considerable sums on spices, but it is more than doubtful if these have any real effect except in persuading animals to eat foods that would be better left alone; it should be possible to achieve palatability in a ration without resort to them. In general, foods, when they come to be fed under practical conditions, live up to the reputation established for them by chemical analysis and digestibility experiment in the laboratory; those few cases where they definitely do better or worse than expected will probably be cleared up eventually on the lines indicated above. Of course, it is possible that there are more things in nutrition than are dreamed of in our philosophy, but it will be a long time before men of science admit that there is any mysterious, intangible, manner in which particular foods may exert special influences on the working of the animal body.

DESCRIPTION	Price per qr. s. d.	Price per qr. lb.	Price per ton £ s.	Manurial value per ton £ s.	Cost of food value per ton £ s.	Starch equiv. per 100 lb.	Price per unit starch equiv. s. d.	Price per lb. starch equiv. d.	Protein equiv. %
Wheat, British	—	—	5 12	0 11	5 1	72	1 5	0·76	9·6
Barley, British feeding	—	—	5 10	0 9	5 1	71	1 5	0·76	6·2
" Danubian	15 0	400	4 3	0 9	3 14	71	1 1	0·58	6·2
" Persian	14 3	"	4 0	0 9	3 11	71	1 0	0·54	6·2
" Russian	15 0	"	4 3	0 9	3 14	71	1 1	0·58	6·2
Oats, English, white	—	—	6 0	0 10	5 10	60	1 10	0·98	7·6
" " black and grey	—	—	5 15	0 10	5 5	60	1 9	0·94	7·6
" Argentine	11 3	320	3 18	0 10	3 8	60	1 2	0·62	7·6
" Chilian tawny	13 6	"	4 15	0 10	4 5	60	1 5	0·76	7·6
" German	20 3	"	7 2†	0 10	6 12	60	2 2	1·16	7·6
" Russian	14 0	"	4 18	0 10	4 8	60	1 6	0·80	7·6
Maize, Argentine	17 0	480	4 0	0 9	3 11	81	0 11	0·49	6·8
Beans, English Winter	—	—	5 10§	1 3	4 7	66	1 4	0·71	20
Peas, English Blue	—	—	7 0§	1 0	6 0	69	1 9	0·94	18
" Indian	—	—	8 0†	1 0	7 0	69	2 0	1·07	18
" Japanese	—	—	15 5†	1 0	14 5	69	4 2	2·23	18
Dari	—	—	7 10	0 11	6 19	74	1 11	1·03	7·2
Milling offals—									
Bran, British	—	—	4 17	1 0	3 17	42	1 10	0·98	10
" broad	—	—	6 5	1 0	5 5	42	2 6	1·34	10
Middlings, fine, imported	—	—	5 15	0 16	4 19	69	1 5	0·76	12
" coarse, British	—	—	5 0	0 16	4 4	58	1 5	0·76	11
Pollards, imported	—	—	4 10	1 0	3 10	60	1 2	0·62	11
Meal, barley	—	—	5 10	0 9	5 1	71	1 5	0·76	6·2
" maize	—	—	5 12	0 9	5 3	81	1 3	0·67	6·8
" " South African	—	—	5 7	0 9	4 18	81	1 3	0·67	6·8
" " germ	—	—	5 12	0 14	4 18	85	1 2	0·62	10
" locust bean	—	—	5 5	0 7	4 18	71	1 5	0 76	3·6
" bean	—	—	8 15	1 3	7 12	66	2 4	1·25	20
" fish	—	—	18 0	2 19	15 1	53	6 0	3·21	48
Maize, cooked flaked	—	—	6 7	0 9	5 18	83	1 5	0·76	8·6
" gluten feed	—	—	5 15	0 18	4 17	76	1 3	0·67	19
Linseed cake, English, 12% oil	—	—	9 10	1 7	8 3	74	2 2	1·16	25
" " " 9% "	—	—	9 2	1 7	7 15	74	2 1	1.12	25
" " " 8% "	—	—	8 17	1 7	7 10	74	2 0	1·07	25
Soya bean cake, 5½% oil	—	—	7 10§	1 18	5 12	69	1 7	0·85	36
Cottonseed cake—									
" " English, 4½% oil	—	—	4 17	1 5	3 12	42	1 9	0·94	17
" " Egyptian, 4½% "	—	—	4 10	1 5	3 5	42	1 7	0·85	17
Decorticated cottonseed meal, 7% oil	—	—	9 5*	1 18	7 7	74	2 0	1·07	35
Ground-nut cake, 6-7% oil	—	—	5 10*	1 5	4 5	57	1 6	0.80	27
Decorticated ground-nut cake, 6-7% oil	—	—	7 10	1 18	5 12	73	1 6	0·80	41
Palm kernel meal, 1-2% "	—	—	5 5§	0 17	4 8	71	1 3	0·67	17
Feeding treacle	—	—	5 15	0 8	5 7	51	2 1	1·12	2·7
Brewers' grains, dried ale	—	—	4 5	0 16	3 9	48	1 5	0·76	13
" " " porter	—	—	3 17	0 16	3 1	48	1 3	0·67	13
Malt culms	—	—	4 10*	1 5	3 5	43	1 6	0·80	16
Dried sugar beet pulp (a)	—	—	4 2	0 8	3 14	65	1 2	0·62	5·2

* At Bristol. † At Liverpool. § At Hull. (a) Carriage paid on 4-ton lots.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of December, 1930, and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative values of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, if palm kernel meal is offered locally at £7 per ton, then since its manurial value is 17s. per ton as shown above, the food value per ton is £6 3s. Dividing this figure by 71, the starch equivalent of palm kernel meal as given in the table, the cost per unit of starch equivalent is 1s. 9d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 0·94d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculation a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own markets. The figures given in the table under the heading manurial value per ton are calculated on the basis of the following unit prices:—N., 8s. 5d.; P_2O_5, 2s. 11½d.; K_2O, 3s. 4d.

Farm Values.—The prices in respect of the feeding stuffs used as bases of comparison for the purposes of this month's calculations are as follow :—

	Starch equivalent Per cent.	Protein equivalent Per cent.	Per ton £ s.
Barley (imported)	71	6·2	4 2
Maize	81	6·8	4 0
Decorticated ground nut cake	73	41·0	7 10
" cotton cake	71	34·0	7 0

(Add 10s. per ton, in each case, for carriage.)

The cost per unit starch equivalent works out at 1·01 shillings, and per unit protein equivalent, 2·19 shillings. An explanation of the method of calculation employed is given in the Report of the Departmental Committee on Rationing of Dairy Cows.*

The table is issued as a guide to farmers respecting the feeding value of their crops in relation to current market prices. (The "food values" which it is recommended should be applied by Agricultural Organizers and other advisers in connexion with advisory schemes on the rationing of dairy cows are given in the November, 1930, issue of the Ministry's JOURNAL.)

FARM VALUES

Crops	Starch equivalent	Protein equivalent	Food value per ton, on farm
	Per cent.	Per cent.	£ s.
Wheat	72	9·6	4 14
Oats	60	7·6	3 17
Barley	71	6·2	4 5
Potatoes	18	0·6	0 19
Swedes	7	0·7	0 9
Mangolds	7	0·4	0 8
Beans	66	20·0	5 10
Good meadow hay	37	4·6	2 7
Good oat straw	20	0·9	1 2
Good clover hay	38	7·0	2 14
Vetch and oat silage	13	1·6	0 17
Barley straw	23	0·7	1 5
Wheat straw	13	0·1	0 13
Bean straw	23	1·7	1 17

* Obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2. Price 6d. net.

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MISCELLANEOUS NOTES

Imperial Fruit Show, 1931

ARRANGEMENTS have been made for holding the Imperial Fruit Show for 1931 at the City Exhibition Hall, Manchester, from October 30 to November 7 next. At Leicester last year it was estimated that practically one-third of the entire population paid a visit to the show, and previous shows have been equally successful. The National Food Council will again stage an exhibit, and this year it is proposed to introduce a honey section, which should prove popular in the district, the adjacent county of Cheshire being one of the chief honey-producing centres in the country.

* * * * * *

The Agricultural Index Number

PRICES of agricultural produce in January were on average 30 per cent. higher than in the base years 1911–13 as compared with 26 per cent. and 48 per cent. respectively a month and a year earlier. With the exception of potatoes, which showed a sharp advance, the price changes in January were generally small. In the base years, however, prices in January were rather lower than in December, thus causing the indices for a large number of commodities to move upwards for the month under review, and the increase of four points in the general index number is largely due to this fact.

In the following table are shown the percentage increases as compared with pre-war prices each month since January, 1926 :—

Month	Percentage increase compared with the average of the corresponding month in 1911-13.					
	1926	1927	1928	1929	1930	1931
January	58	49	45	45	48	30
February	53	45	43	44	44	—
March	49	43	45	43	39	—
April	52	43	51	46	37	—
May	50	42	54	44	34	—
June	48	41	53	40	31	—
July	48	42	45	41	34	—
August	49	42	44	52	35	—
September	55	43	44	52	42	—
October	48	40	39	42	29	—
November	48	37	41	44	29	—
December	46	38	40	43	26	—

Grain.—Wheat prices continued to fall during January, and the average was 6d. per cwt. lower than in December, the index number being reduced by 7 points to 24 per cent. below pre-war. In the case of barley, quotations were not materially altered on the month, but as a decline occurred in the corres-

ponding period of the base years, the index figure showed a rise of 3 points to 3 per cent. above 1911–13. Values for oats were slightly higher, and the index number advanced by 4 points to 16 per cent. below pre-war. As compared with a year ago, all three descriptions of grain were cheaper, wheat by 3s. 11d. per cwt., barley by 4d. and oats by 1s. 2d.

Live Stock.—Prices of fat cattle continued to move in an upward direction, and the index number rose by 7 points to 27 per cent. above pre-war. Fat sheep were about ¼d. per lb. cheaper than in December, but as this reduction was proportionately smaller than that which occurred in the corresponding period of the base years, the index figure was 6 points higher at 50 per cent. in excess of 1911–13. Quotations for bacon pigs rose slightly, and the index figure was 8 points higher at 34 per cent. above pre-war. In the case of porkers, a reduction of nearly 6d. per score was recorded, but as a relatively more pronounced drop took place in the base period, the index for January appreciated by 4 points. Similarly, although values for dairy cows were about 7s. per head lower on the month, a rise of 3 points was recorded in the index number. Store cattle were a trifle dearer at 28 per cent. in excess of 1911–13, but store sheep showed little change either in price or index number. Values for store pigs showed a slight rise, and the index number was 10 points higher at 114 per cent. over pre-war.

Dairy and Poultry Produce.—Milk was a little cheaper on average at 62 per cent. above the level of the base years. Butter prices were maintained, and the index figure rose by 2 points, while the index for cheese was 5 points higher on the month at 21 per cent. above pre-war. Eggs were about 4d. per dozen cheaper than in December, but as a proportionately greater reduction occurred in the base years, the index figure appreciated by 9 points to 23 per cent. over 1911–13. Quotations for poultry moved upwards and the index number showed an advance of 16 points to 47 per cent. above pre-war levels.

Other Commodities.—A further sharp advance was recorded in potato prices during January, and the index figure was 22 points higher at 71 per cent. above 1911–13, whereas a year ago potatoes were 4 per cent. cheaper than pre-war. Hay was practically unchanged either in price or index number. Vegetables generally were dearer at 45 per cent. above the level of the base years. Values for wool continued to decline, and the January index figure was 3 points lower on the month at 22 per cent. below 1911–13.

Index numbers of different commodities during recent months and in January, 1929 and 1930, are shown below :—

Percentage increase as compared with the average prices ruling in the corresponding months of 1911-13.

Commodity	1929	1930				1931
	Jan.	Jan.	Oct.	Nov.	Dec.	Jan.
Wheat	30	30	—7*	—11*	—17*	—24*
Barley	26	7	13	11	Nil	3
Oats..	34	1	—12*	—17*	—20*	—16*
Fat cattle	35	38	31	28	20	27
,, sheep	67	67	62	53	44	50
Bacon pigs	40	90	25	29	26	34
Pork ,, ...	52	98	45	50	53	57
Dairy cows..	33	33	30	31	30	33
Store cattle..	23	25	27	23	22	28
Store sheep..	59	55	62	56	50	48
Store pigs	52	137	107	111	104	114
Eggs	56	40	56	33	14	23
Poultry	45	44	39	36	31	47
Milk	70	67	47	57	65	62
Butter	53	44	14	10	12	14
Cheese	78	37	17	16	16	21
Potatoes	31	—4*	40	46	49	71
Hay	6	38	—4*	—7*	—7*	—8*
Wool	72	32	—12*	—17*	—19*	—22*

* Decrease.

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Trials of Potatoes for Immunity from Wart Disease, 1930

THE trials which are arranged each year by the Ministry with the object of testing new varieties of potatoes for immunity from Wart Disease were again conducted in 1930 on the farm of the National Institute of Agricultural Botany, Ormskirk, Lancashire. The actual field operations and the taking of records were carried out by Mr. Harold Bryan, B.Sc., and Mrs. McDermott, of the Institute, but the trials were conducted on a plan approved by the Ministry.

Forty-seven stocks were included in the second and subsequent years' tests, and all remained immune from Wart Disease. Of the 48 entries for the first year's tests, 6 became infected in the field; 6 proved to be synonyms of existing varieties; 5 were too poor to judge and 36 were distinct varieties.

As in previous years, the results of the trials have been considered by a small committee composed of representatives

of the Ministry of Agriculture and Fisheries, the Department of Agriculture for Scotland and the Ministry of Agriculture for Northern Ireland, and co-ordinated with the results of the trials carried out by the two last-named Departments at Philpstoun and Kilkeel respectively.

The Committee recommended the approval of 38 new varieties, but only 3 of these have actually been added to the approved list. In the remaining cases inclusion has been postponed until such time as the raisers have intimated that the varieties have actually been or will shortly be introduced into commerce. Descriptions are given below of the 3 new varieties, together with those of 8 varieties which were approved as the result of trials carried out in previous years, and which are now being introduced into commerce.

The findings of the Potato Synonym Committee of the National Institute of Agricultural Botany have been accepted by the Ministry where recommendations as to the classification of new varieties as synonymous with existing varieties have been made by that Committee.

A list of the names of varieties which have been approved in recent years as immune from Wart Disease and those of the older approved immune varieties which are known to the Ministry to be in general cultivation in England and Wales may be obtained on application to the Ministry.

EARLY VARIETY

"Arran Pilot"

Sprout .. Blue.
Tuber .. Thick kidney, slightly pointed heel; skin white; flesh pale lemon; eyes shallow; sprout blue.
Haulm and Foliage Medium height, strong, upright spreading towards maturity, irregular growth; medium to dark green; leaflets dense appearance of top growth, terminal leaflet to the perpendicular, lateral leaflets overlapping terminal; leaflets leathery wrinkled appearance; secondary leaflets small and inconspicuous; leaf short; wings straight; stems reddish purple tinge, especially at base.
Flowers .. Blue-purple, tipped white, not numerous; long styles; orange anthers.

SECOND EARLY VARIETIES

"Arran Luxury"

Sprout .. Pink.
Tuber .. Thick kidney shaped; skin white; eyes shallow; flesh white.
Haulm and Foliage Medium height, spreading; stems branching, wings slightly waved; leaf open, rigid; terminal leaflet well clear of last pair of side leaflets; leaflets medium, dull, with long stalks.
Flowers .. Absent; buds purple with green markings; hairs numerous and upstanding.

"Ballydoon"

Sprout .. Pink.
Tuber .. Oval; skin white; flesh white; eyes shallow.
Haulm and Foliage Medium height, spreading, stems branching, main stems strong; leaf open, rigid; leaflets medium to dark green, broad.
Flowers .. White, large and profuse; stalks long and strong; anthers orange; buds dark with green tips; berries occur.

"Cramond Peach"

Sprout .. Pink.
Tuber .. Round; skin white; flesh yellow; eyes shallow.
Haulm and Foliage Low-growing, spreading; yellow-green colour; leaf close, arched; leaflets long, large, lateral leaflets overlapping terminal, hard, wrinkled, dull; secondary leaflets large, numerous, frequently on leaflet stalks; pink mottling general.
Flowers .. None observed.

EARLY MAINCROP VARIETIES

"Albion"

Sprout .. Pink.
Tuber .. Round; skin white; flesh white; eyes shallow.
Haulm and Foliage Medium height to tall, spreading; stems branching, tinged red purple, strong; wing broad; leaflets medium green, slightly wrinkled.
Flowers .. White and profuse; stalks long and strong; buds dark.

"Impressive"

Sprout .. Pink.
Tuber .. Oval, skin white; flesh pale lemon; eyes shallow.
Haulm and Foliage Moderately tall, compact, upright; colour grey-green; leaflets round, dull; secondary leaflets few, inconspicuous; wings straight; pink colouration at base only.
Flowers .. None observed; buds pink, drop.

"Sutton's Commander"

Sprout .. Pink.
Tuber .. Oval, skin white; flesh lemon; eyes shallow and on the point.
Haulm and Foliage Tall, open, upright, vigorous; leaf close, erect; leaflets dark yellow-green, round, pointed, wrinkled, dull; secondary leaflets small, few; wings straight; stems mottled pink especially in the axils, extending to mid-ribs and petioles.
Flowers .. White, large, numerous; orange anthers; dark hairy buds.

LATE MAINCROP VARIETIES

"Dônard"

Sprout ..	Pink.
Tuber ..	White, oval; eyes shallow.
Haulm and Foliage	Medium height to tall, spreading; stems branching; leaf long and spreading; top leaves show a faint tinge of pink at base of leaflet stalks; leaflets light to medium green, large end pair do not as a rule overlap the terminal leaflet; secondary leaflet large and well developed.
Flowers ..	None observed; flower buds small and purple, becoming pink before dropping off.

"Late Exon"

Sprout ..	Pink.
Tuber ..	Kidney; skin white; flesh lemon, soft; eyes shallow to medium.
Haulm and Foliage	Tall, open, upright, weak; leaf open, erect; leaflets very small, stiff appearance; secondary leaflets small; wings slightly serrated; slight reddish purple mottling general.
Flowers ..	White; dark buds; orange anthers.

"Latest of All"

Sprout ..	Faint pink.
Tuber ..	Kidney, irregular; skin white; flesh white; eyes shallow.
Haulm and Foliage	Medium height, moderately strong, upright; colour light yellow-green; leaf erect, rigid appearance; leaflets small, terminal leaflets pointing upwards, hard; secondary leaflets inconspicuous; wings straight; numerous thin green stems.
Flowers ..	White; orange anthers.

"Whoppers"

Sprout ..	Pink.
Tuber ..	Kidney; skin white; flesh lemon; eyes shallow.
Haulm and Foliage	Medium height, weak, open, irregular; colour grey-green; leaflets small, dull, harsh appearance; secondary leaflets small; slight reddish purple colouration general, extending to midrib.
Flowers ..	White; orange anthers.

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Organized Day Class for Girls in Essex

THE first experiment with an Organized Day Class for Girls in Essex seems to show that there is quite a definite demand for this type of agricultural instruction. Twenty-two students (farmers' daughters) were readily obtained for the course which began in January of this year and is now in progress. The class meets in Colchester on one day a week. The subjects dealt with are:—

Dairying.—Composition of milk; cream separating and ripening; butter and soft cheese making.

Poultry Keeping.—Breeds of poultry; hatching and rearing of chicks; feeding and general management of diseases.

Horticulture.—Fruit, vegetable and flower culture; fruit and vegetable bottling; jam and jelly making, etc.

Agriculture.—Rearing of calves; farm accounts, etc.

Lectures are given during the morning session, visits being paid in the afternoon to neighbouring farms and gardens, where the actual operations described in lectures can be demonstrated.

The first visit was made to a fruit farm, belonging to Mr. H. C. Tann, of Aldham. Here a pruning demonstration was given and the class was able to see the whole story of the production of high-grade apples from the planting of a maiden tree onwards. The following week a farm producing Grade A milk was visited, when Mr. Marsh, chief sanitary inspector for the county, was present to address the class.

It is felt that a great deal of useful work can be done, even in so varied a course, and it is hoped that, for some of the students, it will lead on to attendance at some longer and more specialized course at the Institute of Agriculture, Chelmsford.

* * * * * *

Farm Workers' Minimum Wages.—A meeting of the Agricultural Wages Board was held on Tuesday, February 10, 1931, at 7 Whitehall Place, London, S.W.1, the Right Hon. the Viscount Ullswater, G.C.B., presiding.

The Board considered notifications from Agricultural Wages Committees of decisions fixing minimum and overtime rates of wages, and proceeded to make the following Orders carrying these decisions into effect.

Bedfordshire and Huntingdonshire.—An Order cancelling as from March 28 the existing minimum and overtime rates of wages for male and female workers, and fixing fresh rates to come into operation on March 29. The minimum rate in the case of male workers of 21 years of age and over is 30s. 6d. per week of 41 hours in the weeks in which Easter Monday and Whit Monday fall, 50 hours in any other week in summer; 31 hours in the week in which Christmas Day and Boxing Day fall, and 48 hours in any other week in winter (instead of 50 hours per week in summer and 48 hours per week in winter as at present). The overtime rates in the case of male workers of 21 years of age and over are 11d. per hour on Sundays, 10d. per hour on Easter Monday, Whit Monday, Christmas Day and Boxing Day, and 9d. per hour for all other overtime employment. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 9d. per hour on Sundays, 8½d. per hour on Easter Monday, Whit Monday, Christmas Day and Boxing Day, and 7½d. per hour for all other overtime employment. These rates will continue in force until February 27, 1932.

Devonshire.—An Order fixing minimum and overtime rates of wages to come into operation on March 26, 1931, *i.e.*, the day

following that on which the existing rates are due to expire. The minimum rate in the case of male workers of 21 years of age and over is 32s. 6d. per week of 52 hours in summer, 41 hours in the week in which Good Friday falls; 32 hours in the week in which Christmas Day and Boxing Day fall and 50 hours in any other week in winter, with overtime at 8½d. per hour on weekdays and 10d. per hour on Sundays and for all overtime employment on the hay and corn harvests. The minimum rate in the case of female workers of 20 years of age and over is 5d. per hour for all time worked. These rates will continue in operation until March 26, 1932.

Kent.—An Order continuing the operation of the existing minimum and overtime rates of wages from March 1, 1931, until February 29, 1932. The minimum rate in the case of horsemen, stockmen or shepherds of 21 years of age and over is 33s. per week of 42½ hours in the weeks in which Good Friday and Christmas Day fall and 52 hours in any other week with, in addition, 8d. per hour for all employment on customary duties in excess of those hours, but not exceeding 60 hours in any week (including Sunday). The overtime rate in the case of these workers is 9d. per hour except for employment on other than customary duties on Sundays, Good Friday and Christmas Day when the rate is 10d. per hour. In the case of other male workers of 21 years of age and over the minimum rate is 32s. 6d. per week of 42½ hours in the week in which Good Friday falls and 52 hours in any other week in summer; 39 hours in the week in which Christmas Day falls and 48 hours in any other week in winter, with overtime at 9d. per hour on weekdays and 10d. per hour on Sundays, Good Friday and Christmas Day. In the case of female workers of 18 years of age and over the minimum rate is 5½d. per hour with overtime at 6½d. per hour on weekdays and 7d. per hour on Sundays, Good Friday and Christmas Day.

Lincolnshire (Kesteven and Lindsey).—An Order continuing the operation of the existing minimum and overtime rates from March 2, 1931, until March 6, 1932. The minimum rate in the case of waggoners of 21 years of age and over is 39s. per week of 53 hours in summer and 48 hours in winter and such additional hours as may be required for the performance of the customary duties of such workers, but so that the total number of hours per week shall not exceed 61 during the period from October 15 to May 13, and 58 during the remainder of the year. In the case of shepherds of 21 years of age and over the minimum rate is 37s. per week of 53 hours in summer and 48 hours in winter and such additional hours as may be necessary for the performance of customary duties, but so as not to exceed a total of 55 in summer and 56 in winter, additional payments being made for the lambing season. In the case of stockmen of 21 years of age and over the minimum rate is 38s. per week of 53 hours in summer and 48 hours in winter and such additional hours as may be required for the performance of customary duties, but so that the total number of hours per week shall not exceed 56 in summer and 58 in winter. In the case of other male workers of 21 years of age and over the minimum rate is 32s. per week of 48 hours in winter and 53 hours in summer. The overtime rate for all classes of male workers of 21 years of age and over are 9½d. per hour on weekdays and 11½d. per hour on Sundays. The minimum rate of wages for female workers of 17 years of age and over is 5½d. per hour for all time worked.

Middlesex.—An Order continuing the operation of the existing minimum and overtime rates of wages from March 1, 1931, to February 29, 1932. The minimum rates in the case of male workers of 21 years of age and over are, for stockmen 41s. 3d. per week of 60 hours; for carters 38s. 6d. per week of 56 hours; for casual workers 8¼d. per hour and for other male workers 34s. 4½d. per week of 50 hours in summer and 33s. per week of 48 hours in winter, with overtime in each case at 10¼d. per hour. The minimum rates in the case of female workers of 18 years of age and over are, for stockmen 30s. per week of 60 hours; for carters 28s. per week of 56 hours; for casual workers 6d. per hour and for other female workers 25s. per week of 50 hours in summer and 24s. per week of 48 hours in winter, with overtime in each case at 7½d. per hour.

Monmouthshire.—An Order continuing the operation of the existing minimum and overtime rates of wages from March 16, 1931, to March 15, 1932. The minimum rate in the case of male workers of 21 years of age and over is 32s. per week of 54 hours in summer and 50 hours in winter, with overtime at 9½d. per hour on weekdays and 11½d per hour on Sundays, Good Friday, Easter Monday, Whit Monday, August Bank Holiday, Christmas Day and Boxing Day. In the case of female workers of 17 years of age and over the minimum rate is 6d. per hour for all time worked.

Worcestershire.—An Order fixing minimum and overtime rates of wages to come into operation on March 1, 1931, *i.e.*, the day following that on which the existing rates are due to expire, and to continue in force until March 5, 1932. The minimum rate in the case of male workers of 21 years of age and over is 30s. per week of 43 hours (instead of 41½ hours as at present) in the week in which Good Friday falls and 52 hours (instead of 50½ hours as at present) in any other week in summer; 39½ hours in the week in which Christmas Day falls and 48 hours in any other week in winter. The overtime rate in the case of male workers of 21 years of age and over is 9d. per hour (instead of 8d. per hour on Good Friday and Christmas Day and 9d. per hour for all other overtime employment as at present). In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour with overtime at 5¾d. per hour.

East Riding of Yorkshire.—An Order fixing special differential rates of wages for overtime employment on the corn harvest in 1931, the rates in the case of male workers boarded and lodged by their employers being 1s. per hour for foremen, beastmen, shepherds and waggoners, with lesser rates for lads. In the case of other male workers of 21 years of age and over the rate is 1s. 3d. per hour and for female workers of 16 years of age and over 11d. per hour.

Denbigh and Flint.—An Order continuing the operation of the existing minimum and overtime rates of wages from February 16, 1931, until February 15, 1932. The minimum rate in the case of teamsmen, cattlemen, cowmen, shepherds or bailiffs of 21 years of age and over is 37s. per week of 61 hours, and in the case of other male workers of similar age 30s. 6d. per week of 50 hours, with overtime in each case at 9d. per hour. In the case of female workers of 18 years of age and over the minimum rate is 5d. per hour for a week of 48 hours, with overtime at 6¼d. per hour.

Glamorgan.—An Order continuing the operation of the existing minimum and overtime rates of wages from March 2, 1931, until March 1, 1932. The minimum rate in the case of stockmen, cattlemen, cowmen, horsemen, shepherds or bailiffs of 21 years of age and over is 39s. per week of 60 hours with overtime at 11d.

per hour, and in the case of other male workers of 21 years of age and over the minimum rate is 35s. per week of 52 hours in summer and 48 hours in winter, with overtime at 10d. per hour on weekdays and 11d. per hour on Sundays. In the case of female workers of 18 years of age and over the minimum rate is 6d. per hour with overtime at 7d. per hour on weekdays and 7½d. per hour on Sundays.

Copies of the Orders in full may be obtained on application to the Secretary of the Agricultural Wages Board.

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Enforcement of Minimum Rates of Wages.—During the month ending February 14, legal proceedings were instituted against nine employers for failure to pay the minimum rates of wages fixed by the Orders of the Agricultural Wages Board.

Particulars of the cases are as follows :—

County	Court	Fines £	Fines s.	Fines d.	Costs £	Costs s.	Costs d.	Arrears of wages £	Arrears of wages s.	Arrears of wages d.	No. of workers involved
Cheshire	Middlewich		—		0	8	0	32	2	4	1
Derby	Chapel-en-le-frith	4	0	0	1	0	0	22	0	0	4
Gloucester	Cheltenham	5	0	0		—		45	10	3	1
Lancashire	Blackburn	3	0	0	3	11	2	28	19	3	2
Yorks. N.R.	Buxton	0	5	0		—		1	4	9	2
Yorks. W.R.	Halifax	5	0	0		—		5	10	6	1
Anglesey	Llanerchymedd		*			—			—		1
Carmarthen	Llandilo		*			—			—		2
,,	,,		†		1	2	6	4	4	6	1
		£17	5	0	£6	1	8	£139	11	7	15

* Case dismissed.

† Dismissed under Probation of Offenders Act

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Foot and Mouth Disease.—During the present year, two isolated outbreaks of foot-and-mouth disease have been confirmed in Great Britain. The first occurred at Stanmer, Lewes, Sussex, on January 18, and the second at Aspley Guise, Bletchley, Bedfordshire, on January 26. In connection with these outbreaks the usual restrictions were imposed upon areas of approximately 15 miles radius round the infected premises. These restrictions were withdrawn, in respect of the former outbreak on February 9, and in respect of the latter on February 17. The position as this issue goes to press is that there is no part of Great Britain subject to general foot-and-mouth disease restrictions.

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APPOINTMENTS

COUNTY AGRICULTURAL EDUCATION STAFFS : ENGLAND

Hampshire : Mr. W. C. Ibbett,* N.D.H., has been appointed Assistant Horticultural Instructor.

Lancashire : Miss N. S. Milne, N.D.D., has been appointed Assistant Poultry Instructress, *vice* Miss W. W. Young.

* Wholly employed by the County Council, but only partially on agricultural education work.

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